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MUNICIPAL WASTE REPORT, METROPOLITAN DENVER AREA, SOUTH PLATTE RIVER BASIN. APPENDIX B

Public Health Service
Denver, Colorado

December 1965

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Appendix B to municipal waste report metropolitan Denver area, South Platte River Basin (PR-3/app.B) Denver, Colo., December 1965. No LC as of 5/71

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ERRATA SHEET

Appendix B to Municipal Waste Report
Metropolitan Denver Area, South Platte River Basin (December 1965)

Page 76 - Line seven of first paragraph in "Evaluation" - "1965" should be "1966".

APPENDIX B

to

MUNICIPAL WASTE REPORT
METROPOLITAN DENVER AREA
SOUTH PLATTE RIVER BASIN

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Division of Water Supply and Pollution Control
South Platte River Basin Project
Denver, Colorado
December 1965

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INDIVIDUAL REPORTS
MUNICIPAL SEWAGE TREATMENT PLANTS
DENVER METROPOLITAN AREA

IV

INTRODUCTION

This appendix contains individual reports for all municipal sewage treatment plants investigated in conjunction with the Municipal Waste Study in the Denver Metropolitan area of the South Platte River Basin in 1964. Each plant report consists of a discussion, evaluation and flow diagram of treatment facilities. A record of sampling data and a bar graph of plant performance is included for those plants at which Project sampling studies were conducted.

CITY OF BRIGHTON

Type Treatment:	Secondary
Population Served:	7,500 persons
Average Flow:	0.65 million gallons daily
Plant Capacity:	2.0 million gallons daily

Discussion:

The City of Brighton's sewage treatment plant, located adjacent to the South Platte River, northwest of the City of Brighton (River mile, 289.5), is maintained by one operator working an 8-hour shift between 8:00 a.m. and 5:00 p.m. Treatment is provided by the standard low-rate trickling filter process and includes anaerobic digesters and sludge drying beds. Effluent quality of the Brighton Sewage Treatment Plant was severely affected by a blood processing plant located in Brighton prior to November, 1963. Wastes from the blood processing plant were handled without prior treatment by the sewage treatment plant. Since November, 1963 and following the removal of the blood processing factory from Brighton, effluent quality at the Brighton sewage treatment plant has improved considerably.

The Colorado State Department of Public Health routinely checks quality of this sewage treatment plant effluent. Prior to November 1963, effluent quality, measured in terms of Biochemical Oxygen Demand, had reached a level of 75 mg/l. However, during the past year of operation, the Colorado State Department of Public Health tests indicate an average of 15 mg/l on the basis of 4 grab samples. Laboratory test results for samples collected by the Project during the period March 30 to April 3, 1964 indicate an average influent BOD of 220 mg/l, an average effluent quality of 12 mg/l, with an efficiency of 95 percent. Effluent quality when measured in terms of an equivalent population is 280 persons.

The plant effluent normally receives 25 pounds of chlorine per day, resulting in a total chlorine residual of less than 0.1 ppm. A chlorine detention chamber provides 20 minutes of detention time during average flow conditions.

Laboratory facilities have been provided at the plant for the performance of chemical tests of sewage quality. The numbers and types of chemical tests performed are limited to only the most basic analysis. Records of plant operation reflect flows and normal maintenance procedures.

Evaluation:

Comparison of the effluent quality discharged from this plant to current State standards reveals that this plant is presently in conformity with statutes relating to effluent quality discharge. Furthermore, the plant capacity of 2.0 mgd appears to provide ample volume for increased flows in the future. In terms of both plant capacity and effluent quality, and provided that no significant industrial waste discharge is handled by the plant, there appear to be no future problems in the operation of this plant.

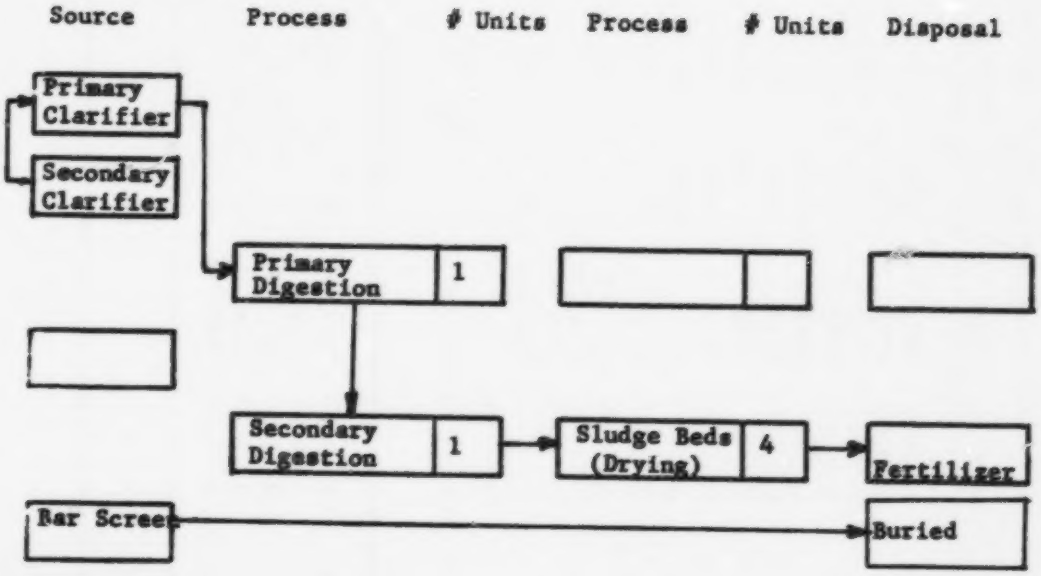
Based upon the "Minimum Recommendations for Operation Control," as adopted by the Conference of State Sanitary Engineers, a plant of this size should have at least two operators and one laborer. In addition, laboratory control should include eight chemical tests. Plant records should reflect results of the laboratory tests, as well as flow, gas production, sludge dried, and other pertinent observations on plant operation. Examination of the operation control at this plant reveals that it is good, but still not in conformity with the recommendations as outlined above.

CITY OF BRIGHTON STP
FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	Screening	Hand Cleaned Bar Screen
1	Grit Removal	Degritor not Used
1	Shredding	Barminutor
1	Sedimentation	Circular (Primary)
1	Filtration	Standard Rate to F.
1	Sedimentation	Circular (Secondary)
1	Metering	Parshall Flume (Recording)
1	Chlorine Addition	Gas Injection
1	Chlorine Detention	Baffled Chamber
	Receiving Stream	South Platte River

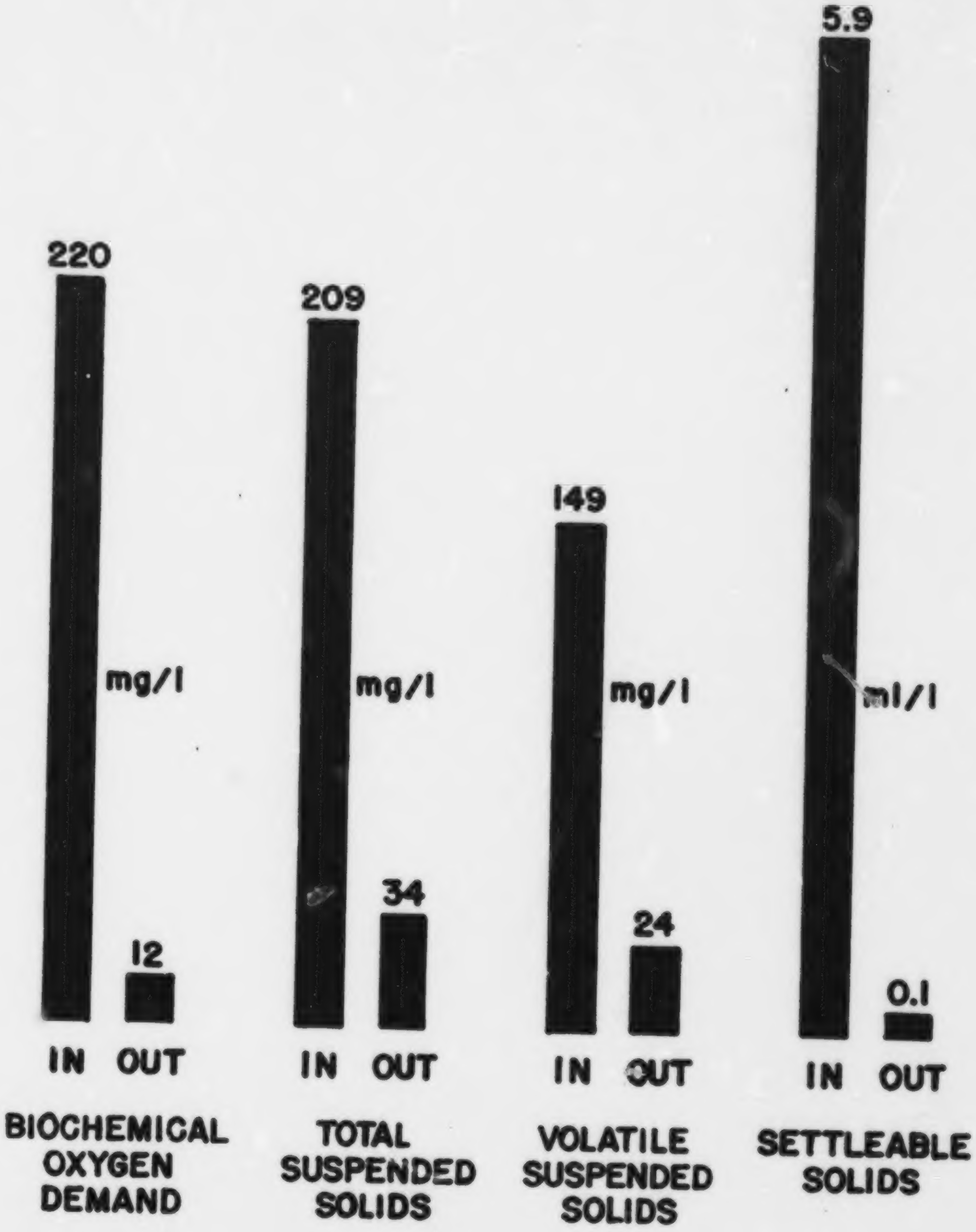
Solids Diagram


Source
Process
# Units
Process
# Units
Disposal
Primary Clarifier
Secondary Clarifier
Primary Digestion
1
Secondary Digestion
1
Sludge Beds (Drying)
4
Fertilizer
Bar Screen
Buried

CITY OF BRIGHTON SEWAGE TREATMENT PLANT

	Date	Time	Sample Type	Temp	pH	BOD	TSS	VSS	Sett Solids	Cl_2Res	Total Coli	Fecal Coli
Effluent	3/30/64	0930	Grab	13.5	8.0	5.1	15	10	<.1	0.2	$7.0x10^{1}$	$1.3x10^{1}$
	3/30/64	1325	Grab	13.5	8.0	20.	--	--	<.1	0.1	$34.5x10^{2}$	$2.7x10^{2}$
	3/31/64	0810	Grab	12.5	7.7	4.0	--	--	.1	0.35	$3.3x10^{1}$	$8.0x10^{0}$
	3/31/64	1230	Grab	13.0	7.9	9.6	--	--	.3	0.15	$4.9x10^{2}$	$1.3x10^{2}$
	4/1/64	0910	Grab	13.0	8.0	10.	--	--	< .1	0.35	$7.9x10^{2}$	$3.3x10^{1}$
	4/1/64	1345	Grab	14.5	8.2	10.	--	--	0.2	0.1	$7.9x10^{2}$	$3.1x10^{1}$
	4/2/64	1100	Grab	13.0	7.8	9.0	31	17	< .1	0.15	$10.9x10^{2}$	$4.9x10^{1}$
	4/2/64	1515	Grab	12.5	7.8	13.0	28	17	.2	< 0.1	$4.9x10^{2}$	$7.9x10^{1}$
	4/3/64	0845	Grab	09.5	7.8	9.1	--	--	< .1	0.35	$7.9x10^{2}$	$4.6x10^{1}$
	4/3/64	1225	Grab	10.0	7.9	12.0	37	36	< .1	< 0.1	$17.2x10^{2}$	$17.2x10^{1}$
	3/30/64	8AM-3PM	C	--	--	13.0	33	26	<.1	--	--	--
	3/31/64	Comp of	C	--	--	12.0	54	39	<.1	--	--	--
	4/ 1/64	8 Grab	C	--	--	25.0	--	--	<.1	--	--	--
	4/ 2/64	Samples	C	--	--	9.5	39	24	<.1	--	--	--
	4/ 3/64		C	--	--	11.0	33	24	<.1	--	--	--
Average					7.9	12.0	34	24	<.1	< .2	$5.2x10^{2}$	$4.8x10^{1}$
Influent	3/30/64	8AM-3PM	C	--	--	225	336	268	8.0	--	--	--
	3/31/64	Comp	C	--	--	185	--	--	5.0	--	--	--
	4/ 1/64	of 8	C	--	--	--	--	--	5.0	--	--	--
	4/ 2/64	Grab	C	--	--	250	67	22	7.0	--	--	--
	4/ 3/64	Samples	C	--	--	--	224	158	4.5	--	--	--
Average						220	209	149	5.9	--	--	--
Percent Removals						95	84	84	98			

CITY OF BRIGHTON S.T.P.
PROJECT RECORD OF PLANT PERFORMANCE
1964



SOUTH ADAMS WATER & SANITATION DISTRICT

Type Treatment: Secondary

Population Served: 16,000 persons

Average Flow: 1.5 million gallons daily

Plant Capacity: 2.5 million gallons daily

Discussion:

The South Adams Water & Sanitation District's sewage treatment plant located adjacent to the South Platte River (River mile 301.2) approximately 2 miles north of Derby, Colorado, is a standard high-rate trickling filter plant with two anaerobic digesters and sludge-drying beds. Three operators maintain this plant, working a total of 120 hours per week. No significant amounts of industrial flow are processed by this plant.

Results of tests performed on samples collected by the Colorado State Department of Public Health indicate a consistent effluent quality measured in terms of Biochemical Oxygen Demand of approximately 40 mg/l. Based upon samples collected by Project personnel, influent quality was determined to be 300 mg/l BOD. BOD of the effluent was 26 mg/l. The average plant efficiency during the period of Project sampling was 91 percent. Effluent quality expressed in terms of an equivalent population is 1,600 persons. Chlorination facilities have been provided at the plant, and are used to chlorinate the effluent. A detention time of approximately 15 minutes during average flow is provided. The total chlorine residual during the period of Project sampling was approximately .1 mg/l.

Complete laboratory equipment for the analysis of sewage quality was provided at the time of construction. However, only four chemical tests are performed routinely by plant personnel. They include pH, and residual chlorine, daily; and suspended solids and volatile acids, weekly. Operating records to reflect flow, gas production, and digested sludge are prepared daily by the Chief Operator.

Evaluation:

The quality of sewage effluent discharged by this plant is well within State standards for effluent discharges. The present flows of 1.5 mgd are below the capacity of 2.5 mgd. In terms of both plant capacity and present effluent quality, and providing that no significant industrial waste is to be treated by the South Adams

Water & Sanitation District sewage treatment plant, this facility will continue to operate satisfactorily in the near future.

The laboratory tests which should be performed in addition to those already being done, include BOD's of raw waste and final effluent two or three times per week; the dissolved oxygen of the receiving stream at least 5 times per week above and below the plant discharges. Where possible, composite samples should be used to determine the various parameters of sewage quality and plant efficiency.

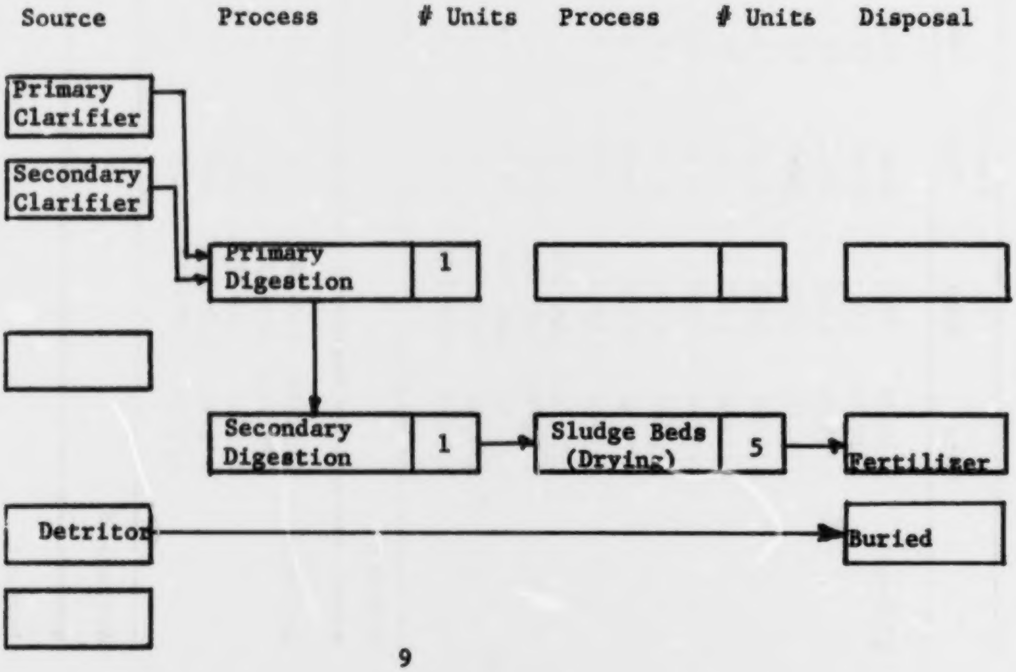
SOUTH ADAMS STP

FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	Metering	Parshall Flume (Recording)
1	Screening	Automatically Cleaned
1	Shredding	Ground Screenings Return to Influent
1	Grit Removal	Detritor (Oscillating bridge)
1	Sedimentation	Circular (Primary)
1	Filtration	High Rate Trickling Filter
1	Sedimentation	Circular (Secondary)
1	Metering	Parshall Flume (Recording)
2	Chlorine Addition	Gas Injection
1	Chlorine Detention	Baffled Chamber
	Receiving Stream	South Platte River

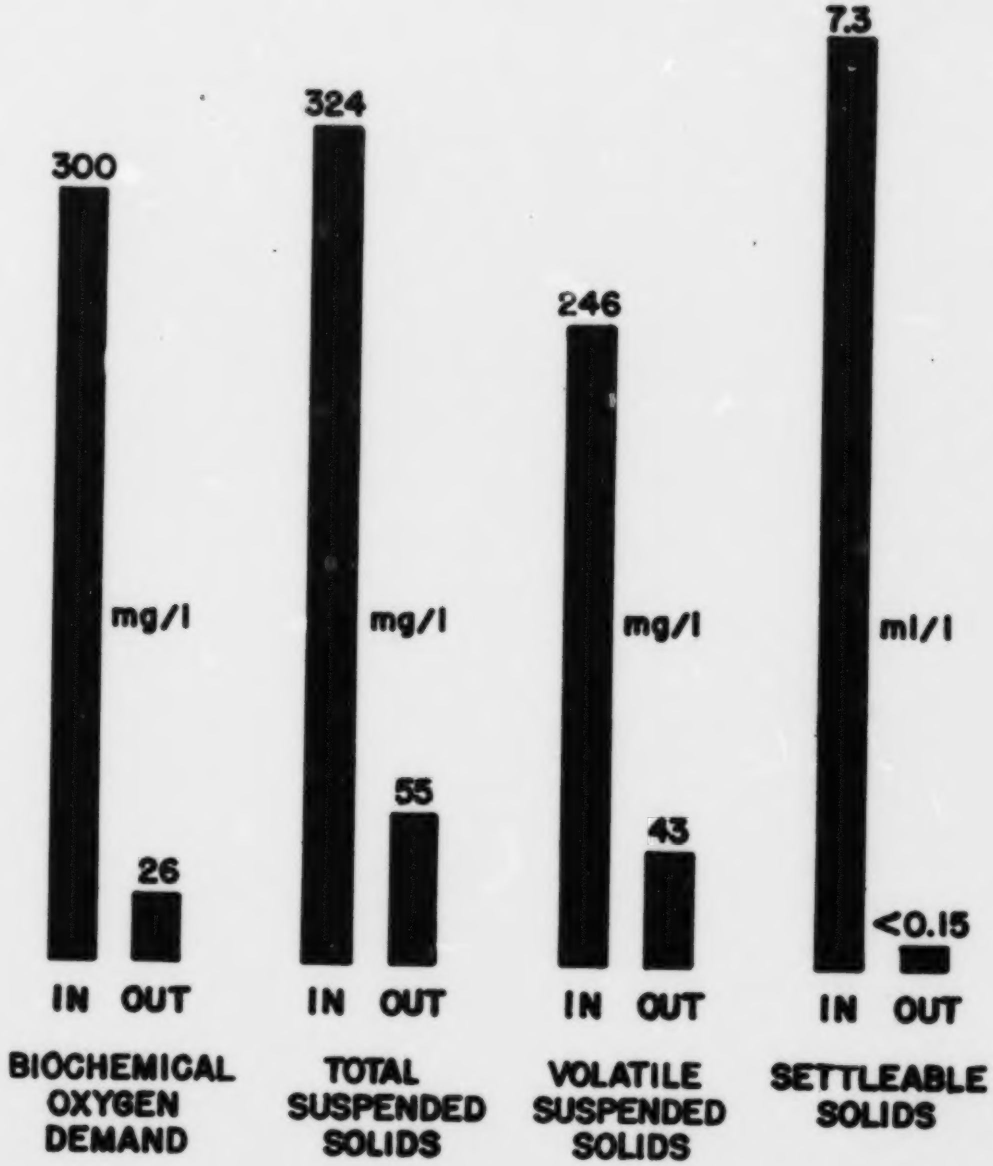
Solids Diagram


Source
Process
# Units
Process
# Units
Disposal
Primary Clarifier
Secondary Clarifier
Primary Digestion
1
Secondary Digestion
1
Sludge Beds (Drying)
5
Fertilizer
Detritor
Buried

SOUTH ADAMS COUNTY SEWAGE TREATMENT PLANT

	Date	Time	Sample Type	Temp	pH	BOD	TSS	VSS	Sett Solids	Cl_2Res	Total Coli	Fecal Coli
Effluent	3/30/64	1000	Grab	12.5	8.2	16	34	17	< .1	0.15	$2.4x10^{2}$	$7.9x10^{1}$
	3/30/64	1350	Grab	12.5	8.1	35	--	--	.1	<0.1	$2.4x10^{4}$	$4.9x10^{3}$
	3/31/64	0835	Grab	12.5	8.0	19	--	--	< .1	0.2	$1.3x10^{3}$	$7.9x10^{2}$
	3/31/64	1250	Grab	13.0	8.1	23	--	--	.2	<0.1	$34.8x10^{4}$	$4.9x10^{4}$
	4/1/64	0845	Grab	13.0	8.1	25	--	--	.2	0.15	$17.2x10^{2}$	$4.9x10^{2}$
	4/1/64	1325	Grab	14.5	7.8	26	--	--	< .1	<0.1	$3.3x10^{2}$	$1.1x10^{1}$
	4/2/64	1045	Grab	12.5	8.0	30	52	37	.1	<0.1	$7.0x10^{3}$	$3.3x10^{3}$
	4/2/64	1500	Grab	12.0	8.1	30	67	38	.3	<0.1	$2.4x10^{5}$	$2.4x10^{5}$
	4/3/64	0820	Grab	9.0	7.8	28	--	--	< .1	0.1	$3.3x10^{3}$	$2.3x10^{3}$
	4/3/64	1210	Grab	8.5	8.0	24	62	61	.2	<0.1	$17.2x10^{2}$	$7.0x10^{2}$
	3/30/64	8AM-3PM	C-8	--	--	26	43	41	< .1	--	--	--
	3/31/64	8AM-3PM	C-8	--	--	24	80	63	< .1	--	--	--
	4/1/64	8AM-3PM	C-8	--	--	30	--	--	< .1	--	--	--
	4/2/64	8AM-3PM	C-8	--	--	35	58	44	< .1	--	--	--
	4/3/64	8AM-3PM	C-8	--	--	22	44	42	< .1	--	--	--
Average					8.0	26	55	43	< .15	< .12	$5.2x10^{3}$	$1.6x10^{3}$
Influent	3/30/64	8AM-3PM	C-8	--	--	365	453	333	4.5	--	--	--
	3/31/64	8AM-3PM	C-8	--	--	270	--	--	6.5	--	--	--
	4/1/64	8AM-3PM	C-8	--	--	220	--	--	7.5	--	--	--
	4/2/64	8AM-3PM	C-8	--	--	340	265	198	10.0	--	--	--
	4/3/64	8AM-3PM	C-8	--	--	--	268	206	8.0	--	--	--
Average						300	329	246	7.3			
Percent Removals						91	83	83	97			

SOUTH ADAMS SEWAGE TREATMENT PLANT PROJECT RECORD OF PLANT PERFORMANCE 1964



CITY OF THORNTON

Type Treatment:	Secondary
Population Served:	35,000 persons
Average Flow:	2.6 million gallons daily
Plant Capacity:	1.9 million gallons daily

Discussion:

The City of Thornton Sewage Treatment Plant, located approximately one and one-half miles southeast of the City of Thornton (River mile 303.5), is a conventional trickling filter plant with anaerobic digesters and sludge-drying beds. Two operators are employed for a period of 8 hours per day to maintain this plant. Rapid development of the area served by this plant has resulted in a severe overloading condition. Sewage flows during the daytime periods of maximum flow are far in excess of the plant capacity and substantial portions of the sewage are bypassed directly to the South Platte River.

Analysis of effluent samples by the Colorado State Department of Public Health during the last two years indicate that effluent quality has risen from 149 mg/1 BOD to 207 mg/1 BOD. Chemical test results for samples collected by the Project personnel during the period March 30, 1964 to April 3, 1964 showed that influent BOD was 355 mg/1, and effluent quality was 205 mg/1 of BOD. Average plant efficiency for the period of sampling was 44 percent. Effluent quality expressed in terms of an equivalent population was 22,000 persons.

Chlorination facilities have been installed in the Thornton Plant and are used occasionally. During the period of sampling, the effluent contained a total chlorine residual of less than 0.1 parts per million. The chlorine detention time following application is far less than the designed time of 15 minutes. This condition is caused by excessive overloading of detention basins.

Very limited laboratory facilities have been provided at the plant. The settleable solids test, using Imhoff cones, is performed infrequently.

Evaluation:

Effluent quality in this plant is above allowable State standards. Present flow is in excess of the designed capacity of the plant. Although this plant was designed for approximately 19,400 people, the present connected population is 35,000, or approximately 185 percent of the design capacity.

Operation control is virtually non-existent at this plant. Minimum Recommendations for a plant of this size and degree of treatment provide that at least three operators and one laborer be employed. Recommended laboratory tests for a plant of this size include settleable solids daily, relative stability daily, BOD's 2 to 3 times weekly, suspended solids of raw waste and effluent preferably twice a week, pH of digested sludge, total solids of digested sludge, dissolved oxygen of receiving stream at least twice a week, and chlorine residual of effluent twice daily. Records of all laboratory tests as well as flow and other operating data should become an integral part of the plant procedure.

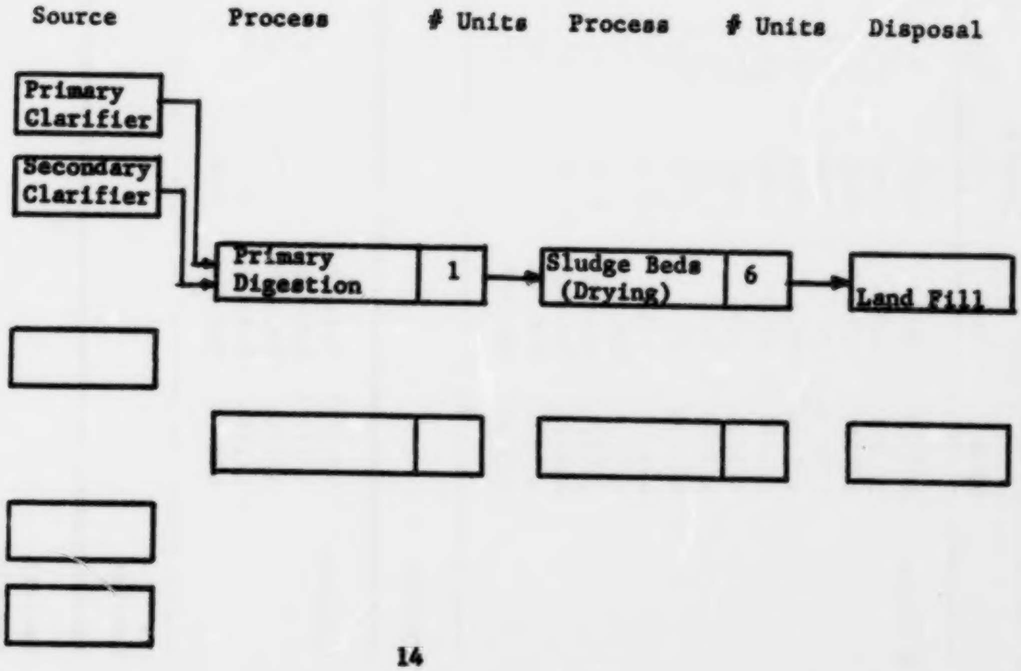
CITY OF THORNTON STP

FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	Sedimentation	Circular (Primary)
1	Filtration	High Rate Trickling Filter
1	Sedimentation	Circular (Secondary)
1	Chlorine Addition	
1	Chlorine Detention	Baffled Chamber
1	Measuring	Parshall Flume
	Receiving Stream	South Platte River

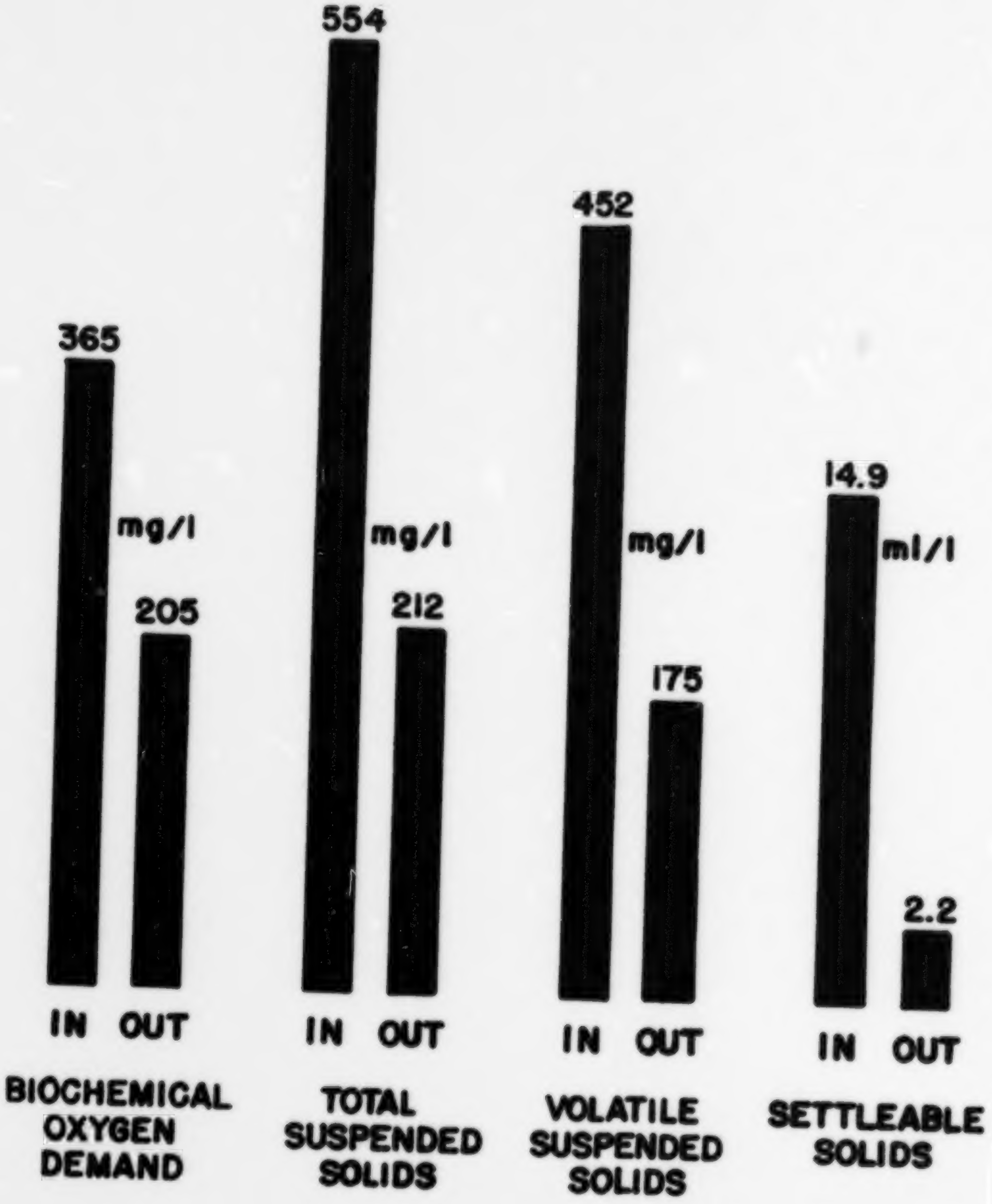
Solids Diagram


Source
Process
# Units
Process
# Units
Disposal
Primary Clarifier
Secondary Clarifier
Primary Digestion
1
Sludge Beds (Drying)
6
Land Fill

THORNTON SEWAGE TREATMENT PLANT

	Date	Time	Sample Type	Temp	pH	BOD	TSS	VSS	Sett Solids	Cl$_2$Res	Total Coli	Fecal Coli
Effluent	3/30/64	1015	Grab	18.0	7.5	260	450	355	2.5	0.1	7.9×10^7	10.9×10^6
	3/30/64	1400	Grab	16.5	7.5	240	--	--	1.2	< 0.1	4.9×10^7	7.0×10^6
	3/31/64	0900	Grab	13.5	7.8	180	--	--	1.8	< 0.1	22.1×10^6	7.9×10^6
	3/31/64	1310	Grab	15.0	7.8	190	--	--	1.2	< 0.1	6.3×10^6	3.3×10^6
	4/1/64	0825	Grab	12.5	7.9	150	--	--	2.2	0.1	7.9×10^7	10.9×10^6
	4/1/64	1300	Grab	15.5	7.7	175	--	--	1.2	< 0.1	4.9×10^7	1.3×10^7
	4/2/64	1030	Grab	14.0	7.6	250	194	154	2.5	< 0.1	4.6×10^7	7.9×10^6
	4/2/64	1450	Grab	14.0	7.7	175	118	92	2.5	< 0.1	3.3×10^7	2.4×10^7
	4/3/64	0800	Grab	10.5	7.5	120	89	73	1.4	< 0.1	17.2×10^6	3.3×10^6
	4/3/64	1150	Grab	11.0	7.4	305	165	135	2.5	< 0.1	7.0×10^7	3.1×10^6
	3/30/64	8AM-3PM	C-8	--	--	200	284	244	2.0	--	--	--
	3/31/64	8AM-3PM	C-8	--	--	185	194	170	< .1	--	--	--
	4/1/64	8AM-3PM	C-8	--	--	175	--	--	1.7	--	--	--
	4/2/64	8AM-3PM	C-8	--	--	235	200	180	5.5	--	--	--
	4/3/64	8AM-3PM	C-8	--	--	240	--	--	5.0	--	--	--
Average					7.6	205	212	175	2.2	< 0.1	3.6×10^7	7.5×10^6
Influent	3/30/64	8AM-3PM	C-8	--	--	315	438	382	7.0	--	--	--
	3/31/64	8AM-3PM	C-8	--	--	285	--	--	9.0	--	--	--
	4/1/64	8AM-3PM	C-8	--	--	505	--	--	8.5	--	--	--
	4/2/64	8AM-3PM	C-8	--	--	350	347	291	15.0	--	--	--
	4/3/64	8AM-3PM	C-8	--	--	--	876	684	35.0	--	--	--
Average						365	554	452	14.9			
Percent Removals						44	62	61	85			

CITY OF THORNTON S.T.P.
PROJECT RECORD OF PLANT PERFORMANCE
1964



NORTH WASHINGTON STREET WATER & SANITATION DISTRICT

Type Treatment: Primary

Population Served: 12,000 persons

Average Flow: 1.4 million gallons daily

Plant Capacity: 1.0 million gallons daily

Discussion:

The North Washington Water & Sanitation District sewage treatment plant, located at the confluence of Clear Creek and the South Platte River (River mile 305.5) consists of bar screens, primary clarifier, trickling filter and anaerobic digesters followed by sludge drying beds. One operator and one laborer are employed a total of 80 hours per week to maintain this plant. Four slaughterhouse operations discharging an average daily flow of 350,000 gallons per day have rendered this plant unable to produce an effluent of satisfactory quality.

Colorado State Department of Public Health data indicates that the effluent from this plant during the three-year period 1960 to 1962 ranged from 343 mg/l to 613 mg/l BOD. Results of samples collected by Project personnel during the period March 30 through April 3 showed an influent BOD of 1150 mg/l and an effluent BOD of 435 mg/l, with an average reduction of 62 percent. Effluent quality expressed by an equivalent population is 27,900 persons.

No chlorination facilities have been provided at this plant.

No laboratory equipment is available at this plant and no chemical tests are performed. No records of operation are maintained.

Evaluation:

Present effluent quality at this plant exceeds the State standards for all four parameters of effluent discharge. Furthermore the present flows processed by North Washington Street Sanitation District are much greater than the designed capacity of the plant. Future flows and loadings will only serve to deteriorate the effluent quality of this plant to an even greater extent than present flows and loading have affected the effluent discharge. Inasmuch as this district is already committed to membership in the Metropolitan Denver

Sewage Disposal District No. 1, discharge from this plant will be 50 mg/l BOD or discontinued by January 1, 1967.

Operation control features of this plant fall far short of the recommended standards for a plant of this size and degree of treatment. The State Conference of State Sanitary Engineers has recommended that for a plant of this size the following laboratory tests be performed: settleable solids, daily; relative stability, daily; BOD's of raw waste and final effluent at least once per week; suspended solids of final effluent and raw waste at least once per week; pH of digested sludge; total solids of digested sludge; D.O. at least twice a week; and chlorine residuals of the effluent daily. In addition to recording the results of these tests, the recommendations include that such items as flow, sludge volume, gas production and other pertinent observations of operational features be recorded.

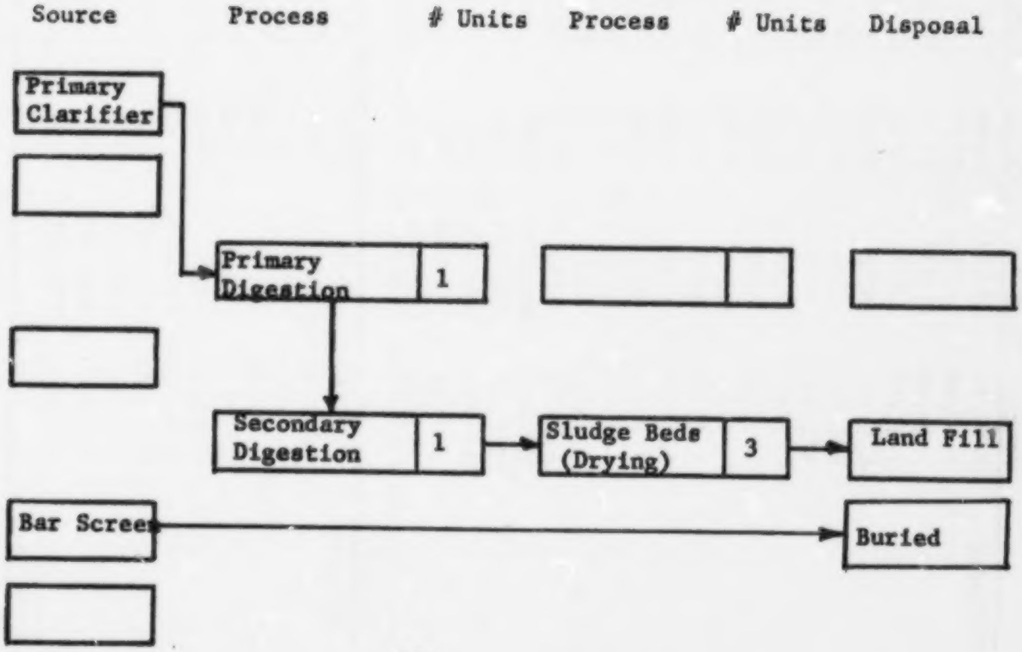
NORTH WASHINGTON STP

FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	Screening	Hand-Cleaned Bar Screen
1	Sedimentation	Circular (Primary)
1	Filtration	Trickling Filter
	Receiving Stream	Clear Creek at Intersection with South Platte River

Solids Diagram

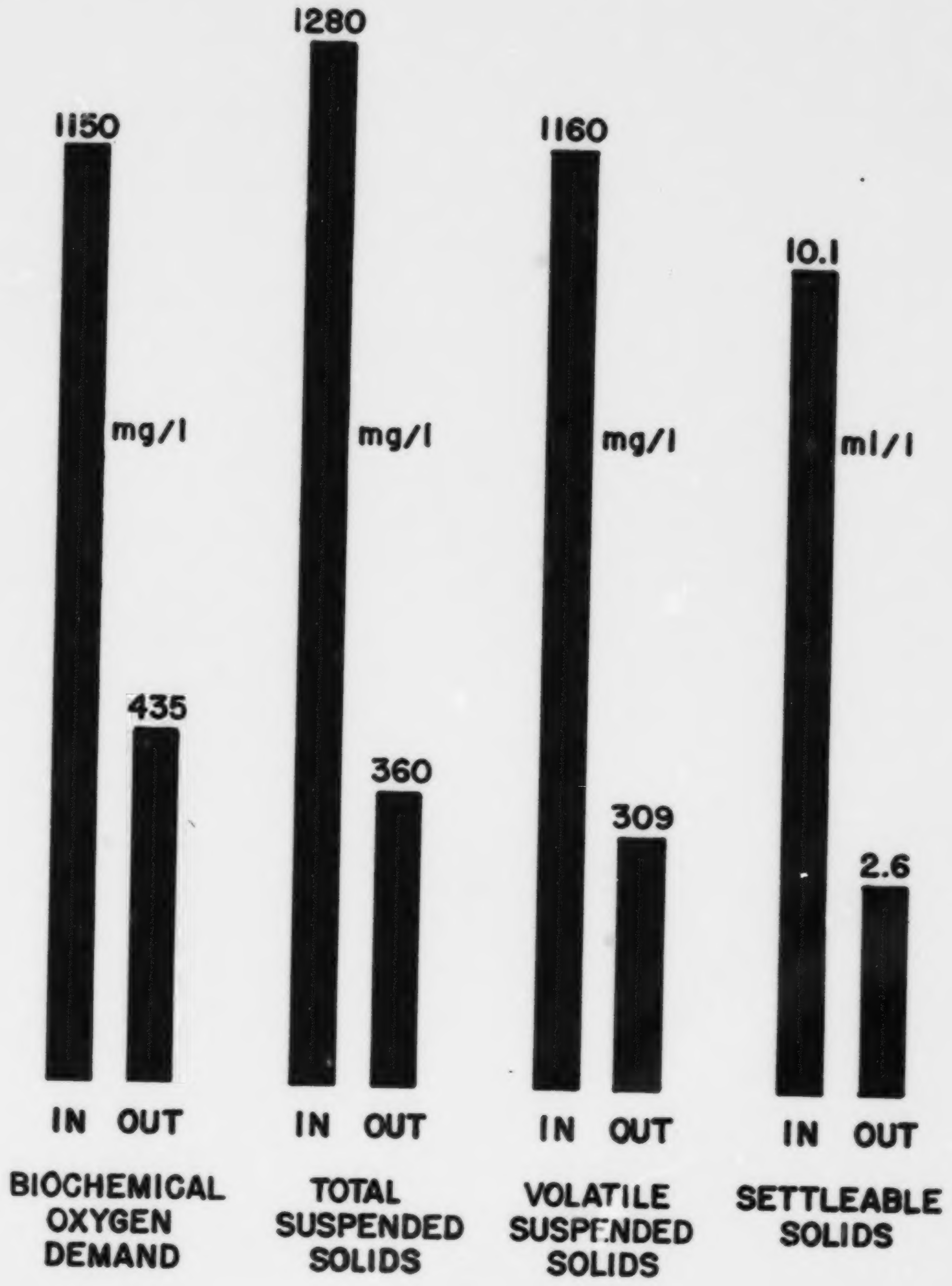

Source
Process
# Units
Process
# Units
Disposal
Primary Clarifier
Primary Digestion
1
Secondary Digestion
1
Sludge Beds (Drying)
3
Land Fill
Bar Screen
Buried

NORTH WASHINGTON SEWAGE TREATMENT PLANT

	Date	Time	Sample Type	Temp	pH	BOD	TSS	VSS	Sett Solids	Cl_2Res	Total Coli	Fecal Coli
Effluent	3/30/64	1045	Grab	15.0	7.5	>150*	182	138	8.0	--	$3.3x10^{7}$	$7.9x10^{6}$
	3/30/64	1415	Grab	17.5	7.6	>155*	--	--	.1	--	$4.9x10^{7}$	$4.9x10^{6}$
	3/31/64	0920	Grab	15.5	7.5	>160*	--	--	1.0	--	$7.9x10^{7}$	$2.4x10^{7}$
	3/31/64	1330	Grab	15.5	7.7	>165*	--	--	0.6	--	$2.4x10^{7}$	$7.9x10^{6}$
	4/1/64	0800	Grab	14.5	7.5	>155*	--	--	2.0	--	$17.2x10^{6}$	$10.9x10^{6}$
	4/1/64	1240	Grab	19.5	7.6	--	--	--	1.0	--	$7.0x10^{7}$	$4.6x10^{7}$
	4/2/64	1125	Grab	15.0	7.5	--	236	194	1.6	--	$7.9x10^{7}$	$17.2x10^{6}$
	4/2/64	1535	Grab	15.0	7.7	--	320	300	1.8	--	$7.0x10^{7}$	$1.3x10^{7}$
	4/3/64	0910	Grab	8.0	7.1	--	446	388	5.0	--	$3.3x10^{7}$	$4.9x10^{6}$
	4/3/64	1250	Grab	10.0	7.6	--	252	198	0.9	--	$4.9x10^{7}$	$1.3x10^{9}$
	5/13/64	0905	Grab	17.5	--	335	220	181	1.4	--	--	--
	5/13/64	1125	Grab	18.0	--	500	--	--	1.8	--	--	--
	5/14/64	0945	Grab	19.0	--	350	182	163	.5	--	--	--
	5/14/64	1255	Grab	20.5	--	--	370	344	2.3	--	--	--
	5/15/64	1200	Grab	21.0	--	430	220	180	0.9	--	--	--
	5/15/64	1355	Grab	21.5	--	570	246	218	0.8	--	--	--
	3/20/64	8AM-3PM	C-8	--	--	>140*	456	386	4.0	--	--	--
	3/31/64	8AM-3PM	C-8	--	--	>150*	433	408	6.0	--	--	--
	4/1/64	8AM-3PM	C-8	--	--	--	--	--	8.5	--	--	--
	4/2/64	8AM-3PM	C-8	--	--	--	448	340	4.0	--	--	--
	4/3/64	8AM-3PM	C-8	--	--	--	1024	896	2.0	--	--	--
Average					7.5	435	360	309	2.6		$4.5x10^{7}$	$1.2x10^{7}$
Influent	5/13/64	0900	Grab	19.0	--	560	4429	386	7.0	--	--	--
	5/13/64	1120	Grab	22.0	--	1340	1062	980	6.0	--	--	--
	5/14/64	0950	Grab	20.0	--	1130	2420	2260	12.5	--	--	--
	5/14/64	1255	Grab	22.0	--	--	--	--	8.5	--	--	--
	5/15/64	1205	Grab	21.5	--	1560	930	900	0.4	--	--	--
	5/15/64	1400	Grab	23.0	--	--	1640	1490	9.0	--	--	--
	3/30/64	8AM-3PM	C-8	--	--	> 720*	1592	1412	16.5	--	--	--
	3/31/64	8AM-3PM	C-8	--	--	> 835*	--	--	14.0	--	--	--
	4/1/64	8AM-3PM	C-8	--	--	> 910*	--	--	15.0	--	--	--
	4/2/64	8AM-3PM	C-8	--	--	--	1144	950	12.0	--	--	--
	4/3/64	8AM-3PM	C-8	--	--	--	1000	870	10.0	--	--	--
Average						1150	1280	1160	10.1			
Percent Removals						62	72	73	74			

*Not included in Average

NORTH WASHINGTON S.T.P.
PROJECT RECORD OF PLANT PERFORMANCE
1964



CITY OF DENVER (NORTHSIDE PLANT)

Type Treatment:	Primary
Population Served:	600,000 persons
Average Flow:	70.5 million gallons daily
Plant Capacity:	85 million gallons daily

Discussion:

The main City of Denver sewage treatment plant (Northside) is located adjacent to the South Platte River at its intersection with 52nd Avenue (River mile 308.8). Facilities at this plant include mechanically-cleaned bar screens, automatic grit removal facilities, aeration basins and 6 primary clarification basins. Sludge from this operation is handled by 8 anaerobic digesters and sludge drying beds. A total of 60 men, including superintendent, operators, chemists, maintenance men and laborers are required to operate the plant. Industrial contributions constitute a significant portion of the flows experienced at the plant. During a 5-day work week, wastes from industrial sources constitute approximately 30 percent of the daily flow.

Samples collected and analyzed daily by plant personnel indicate that the biochemical oxygen demand of effluent discharge to the South Platte River is 151 mg/l. This figure represents an average of all BOD determinations made during the period December 1963 through November 1964. Based upon a 5-day week for the corresponding period, the average effluent BOD was 174 mg/l. The influent BOD was 278 mg/l for a 7-day week average and 300 mg/l for a 5-day week average. Corresponding to these values are an average percentage reduction of 45 percent for a 7-day week and 42 percent for a 5-day week. Effluent quality expressed in terms of an equivalent population is 656,000 persons, based on a 5-day week.

Chlorination facilities have been provided at the plant and are used to chlorinate the effluent. During the period of Project sampling the average chlorine residual was less than 0.3 mg/l. Chlorine detention time is provided in basins originally built for the now-inoperative magnetite filter process.

A laboratory complete with equipment needed to perform the most rigorous of sewage-quality analysis has been provided in this plant. The three chemists employed perform all tests which are necessary to the operation of a plant this size and complexity. A daily record of all laboratory analyses as well as operational control records are maintained daily by the chief chemist and plant superintendent.

Evaluation:

The degree of treatment achieved by the Denver Northside treatment plant is unusually good, considering that this is a primary plant. However, considering the load imposed upon the plant and the quality of effluent discharge, the facility is no longer adequate to handle the City of Denver waste discharges. Inasmuch as this plant is committed to membership in the Metropolitan Denver Sewage Disposal District No. 1, waste discharges to the South Platte River will be discontinued by January 1, 1967.

Operation of this plant is in conformance with the recommendations for minimum personnel and laboratory control and records.

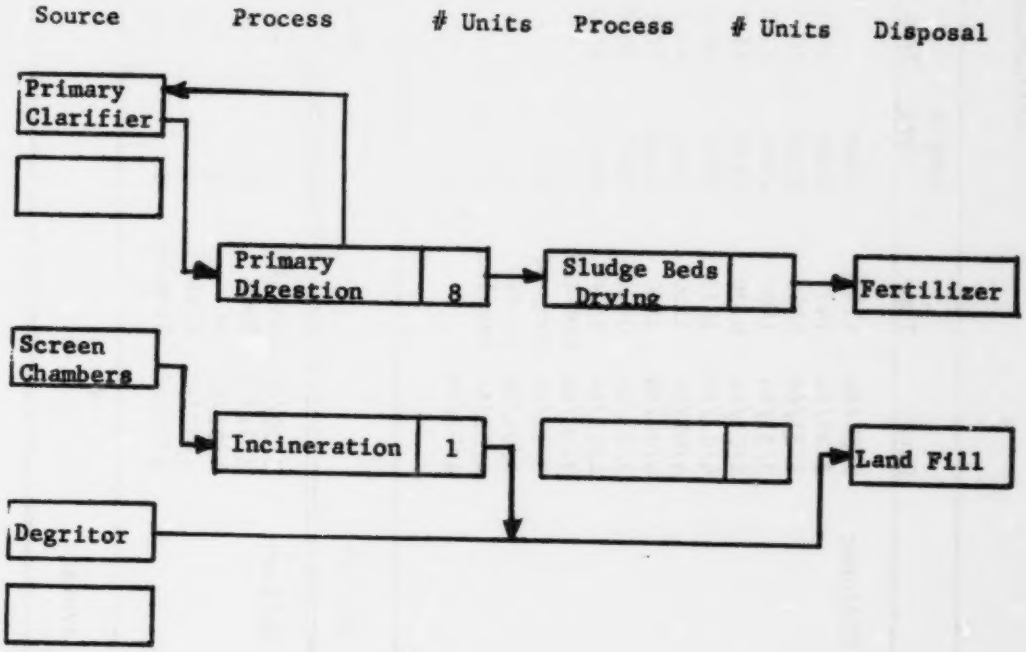
CITY OF DENVER (NORTHSIDE) STP

FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	Metering	Venturi Tube
5	Screening	Automatically Cleaned
3	Grit Removal	Degritor
3	Pre-Aeration	Forced-Air Rectangular Chambers
6	Sedimentation	Circular (Primary)
4	Chlorine Addition	Gas Injection
2	Flash Mixing	Vertical Prop-type
6	Chlorine Detention	Rectangular - straight flow
1	Metering	Venturi Tube
	Receiving Stream	South Platte River

Solids Diagram


Source
Process
# Units
Process
# Units
Disposal
Primary Clarifier
Primary Digestion
8
Sludge Beds Drying
Fertilizer
Screen Chambers
Incineration
1
Land Fill
Degritor

CITY OF DENVER (NORTHSIDE PLANT) *

	Date	Time	Sample Type	Temp	pH	BOD	TSS	VSS	Sett Solids	Cl_2 Res	Total Coli	Fecal Coli
Effluent	3/30/64	1115	Grab		8.0	155	140	118	.3	0.75	4.9×10^3	4.9×10^3
	3/30/64	1435	Grab	16.5	7.7	255	-	-	0.6	0.75	17.2×10^4	1.3×10^5
	3/31/64	0945	Grab	16.5	7.5	140	-	-	<0.1	0.15	22.1×10^2	7.0×10^2
	3/31/64	1400	Grab	17.5	7.8	>310	-	-	0.3	0.1	3.3×10^5	7.0×10^4
	4/01/64	0730	Grab	15.5	7.7	195	-	-	0.2	<0.1	1.3×10^6	7.9×10^5
	4/01/64	1215	Grab	18.0	7.9	-	-	-	0.4	<0.1	7.9×10^4	4.9×10^4
	4/02/64	1150	Grab	16.5	7.8	225	159	122	0.3	<0.1	1.3×10^4	7.9×10^3
	4/02/64	1550	Grab	17.0	7.7	220	130	98	0.3	<0.1	7.0×10^4	7.0×10^4
	4/03/64	0925	Grab	14.0	7.4	120	142	124	0.2	0.5	4.9×10^2	3.3×10^2
	4/03/64	1320	Grab	15.0	7.6	270	197	166	0.3	<0.1	2.4×10^4	2.4×10^4
	3/30/64	8AM-4PM	C	--	--	210	122	106	<0.1	--		
	3/31/64	Comp of	C	--	--	200	164	104	<0.1	--		
	4/01/64	9 Grab	C	--	--	210	--	--	<0.0	--		
	4/02/64	Samples	C	--	--	210	156	118	0.6	--		
	4/03/64		C	--	--	230	140	108	<0.1	--		
Average				16.5	7.7	>210	150	118	< 0.3	< 0.3	3.0×10^4	1.9×10^4
Influent	3/30/64	8AM-4PM	C	--	--	>370	402	336	8.0	--		
	3/31/64	Comp	C	--	--	>415	--	--	8.0	--		
	4/01/64	of 8	C	--	--	--	--	--	9.0	--		
	4/02/64	Grab	C	--	--	>360	392	322	9.5	--		
	4/03/64	Samples	C	--	--	--	494	358	9.0	--		
Average						≥ 390	428	355	8.7			
Percent Removals						46	65	67	9.7			

* Note - More comprehensive data obtained from plant operating records were used in the Project report for evaluation purposes.

SOUTH LAKEWOOD SANITATION DISTRICT

Type Treatment: Secondary

Population Served: 6,500 persons

Average Flow: 0.6 million gallons daily

Plant Capacity: 0.6 million gallons daily

Discussion:

The South Lakewood Sanitation District operates an extended aeration sewage treatment plant located adjacent to Lakewood Gulch at its intersection with Sheridan Boulevard. Effluent is discharged through an interceptor which conveys the wastes from the plant to the South Platte River (River mile 314.1). One operator is on duty at the plant for approximately 8 hours per day. These facilities include a trickling filter, 6 aeration tanks and two final clarifiers followed by a lagoon-type holding pond. A seventh aeration basin is used for aerobic digestion of the sludge, from which digested sludge is distributed on a field within the plant's confines.

Effluent to the South Platte River as determined by the Colorado State Department of Public Health has shown a gradual improvement over the three-year period beginning in 1962 and ending in 1964. Biochemical Oxygen Demand of the effluent in 1962 was 75 mg/l; in 1963, it was determined to be 60 mg/l and in 1964, based upon Project sampling, effluent quality was measured at 52 mg/l. This gradual improvement of effluent quality is largely due to in-plant modification of sludge return to the aeration units. Average influent BOD was determined at the time of Project sampling to be 270 mg/l for an average reduction of 81 percent. Population equivalent of the effluent was determined to be 1,100 persons.

Chlorination facilities have been provided at the plant and the effluent is chlorinated with approximately 40 pounds of chlorine per day. Chlorine detention time is provided by the holding pond mentioned above.

A limited amount of laboratory equipment was provided in the plant design. Very few tests are performed on a routine basis. A fairly complete record of plant operation is maintained.

Evaluation:

The quality of effluent discharged by this plant is slightly in violation of the State standard for BOD. Due to the fact that present flows have reached the design capacity, additional plant facilities will be required to assure conformance with the current State standard.

Laboratory equipment available to the operator of this plant is insufficient to provide laboratory control for a plant of this size and complexity. The operator has been concerned with plant operation to such an extent that he has collected samples and taken them to another treatment plant to have necessary tests run. At the present time, this plant does not conform to recommendations for minimum operation control.

SOUTH LAKEWOOD SANITATION DISTRICT
FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	Parshall	Telemetered Flows to Recorder
1	Grit Removal & Screen	Degrittor
6	Aeration	6 Hi-cone Mechanical Aerators
2	Sedimentation	Rectangular
1	Chlorine addition	
1	Chlorine Detention	Pond
	Receiving Stream	South Platte River

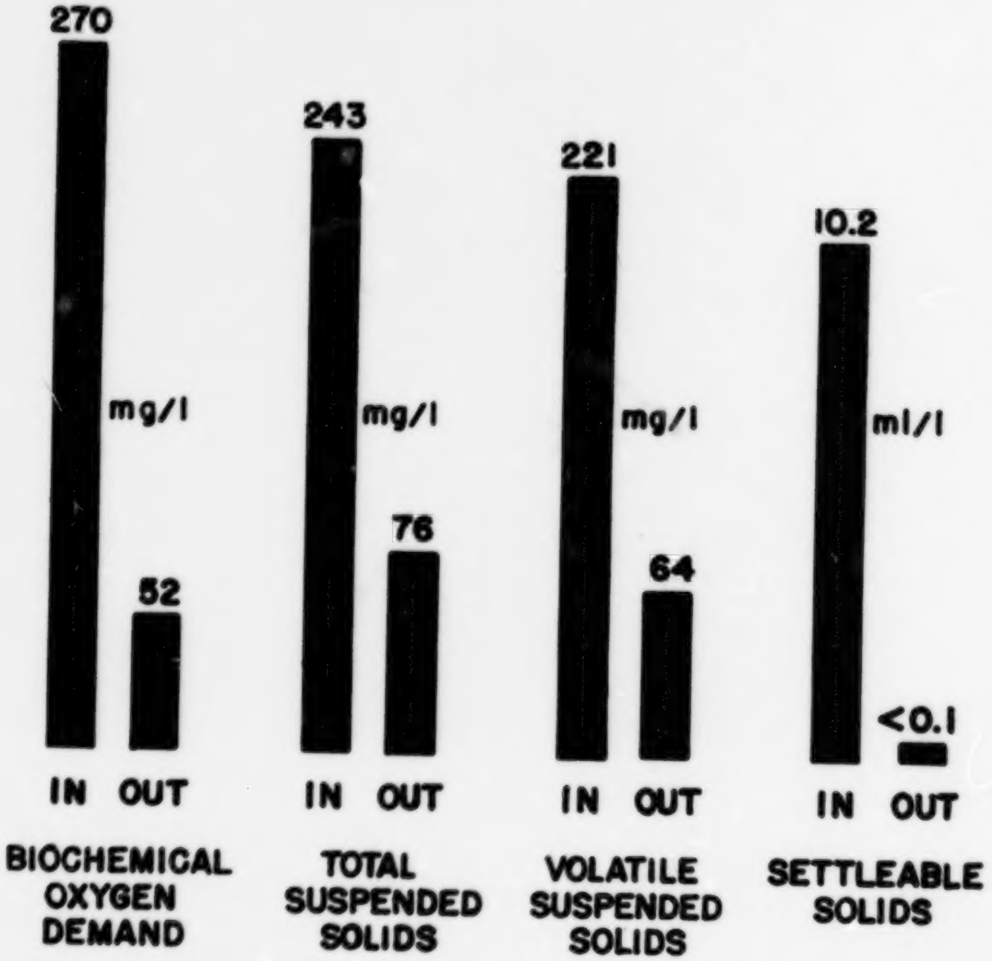
Solids Diagram

Source	Process	# Units	Process	# Units	Disposal
Clarifiers	Aerobic Digestor	1	Distributed to Plant Grounds		
Degrittor	Trench Burial				

SOUTH LAKEWOOD SEWAGE TREATMENT PLANT

	Date	Time	Sample Type	BOD	TSS	VSS	Settleable Solids
Effluent	9/ 8/64	8AM-3PM	C	47	54	48	< 0.1
	9/10/64	8AM-3PM	C	49	93	77	< 0.1
	9/11/64	8AM-3PM	C	59	82	67	< 0.1
Average				52	76	64	< 0.1
Influent	9/ 8/64	8AM-3PM	C	305	124	124	8.5
	9/10/64	8AM-3PM	C	245	248	221	11.0
	9/11/64	8AM-3PM	C	255	357	317	11.0
Average				270	243	221	10.2
Percent Removals				81	69	71	99

SOUTH LAKEWOOD S. T. P.
PROJECT RECORD OF PLANT PERFORMANCE
1964



CITY OF ENGLEWOOD

Type Treatment: Secondary

Population Served: 55,200 persons

Average Flow: 4.5 million gallons daily

Plant Capacity: 8 million gallons daily

Discussion:

The City of Englewood operates two identical sewage treatment plants located on the east bank of the South Platte River between Yale and Hampden Avenues (River mile 319.7). Effluent from these plants, after receiving treatment by the high-rate trickling filter process, are combined in a single outfall discharging to the South Platte River. Domestic sewage originating within the boundaries of the City of Englewood are handled by one plant; and additional sewage originating from areas outside the City of Englewood (approximately 30 percent of the flow) is processed by the second plant. One superintendent and 5 operators are employed to provide 24-hour operation of these plants.

Samples collected by the Colorado State Department of Public Health for the 3-year period beginning in 1960 and ending in 1962, indicate that effluent discharged from the City of Englewood's sewage treatment plant increased from 36 mg/l biochemical oxygen demand to 56 mg/l BOD in 1962. 1963 effluent quality was measured at 50 mg/l. Samples collected and analyzed routinely by the plant superintendent indicate that the effluent discharged from the City of Englewood's sewage treatment plant increased from 36 mg/l biochemical oxygen demand to 56 mg/l BOD in 1962. 1963 effluent quality was measured at 50 mg/l. Samples collected and analyzed routinely by the plant superintendent indicate that the effluent discharge is presently below 50 mg/l BOD. Samples collected and analyzed by Project personnel indicate an effluent quality of 48 mg/l for the period September 8-11, 1964. Additional samples collected by the Project during this same period showed influent quality to be 240 mg/l. The percentage efficiency of the plant during this period was 80 percent. The population equivalent of the effluent during this period was 8,440 persons.

Chlorination facilities have been provided at the plant and are used to chlorinate the combined effluents with 20 pounds of chlorine per day. Minimal retention time is provided within the outfall to the river.

Sufficient equipment is available at this plant to perform the numbers and types of tests recommended by the 1963 Conference of State Sanitary Engineers. The plant superintendent has estimated that 36 hours per week are devoted to laboratory testing and the keeping of plant records. The types of laboratory analyses which are performed include BOD, settleable solids, suspended solids, total solids, and other laboratory tests pertinent to the operation of the digesters. Operating records include daily flows, gas produced, and grit removed.

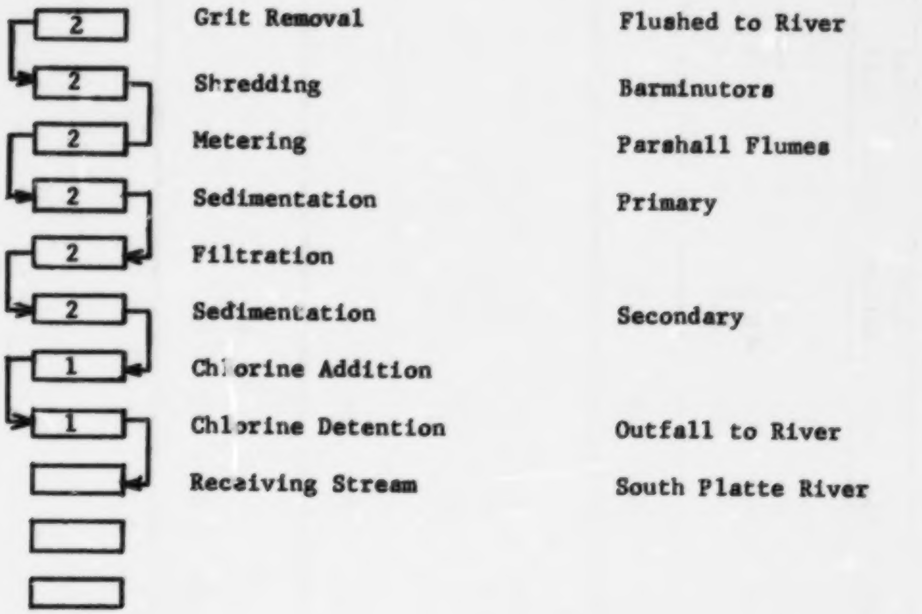
Evaluation:

At the present time this plant has sufficient capacity in terms of both flow and degree of treatment provided to handle the waste loads from the City of Englewood. The State standard for effluent discharge of 50 mg/l BOD is not presently exceeded by this plant. The 8 mgd. capacity of this plant appears to be adequate for present day flow conditions. The fact that the effluent quality reaches a level only slightly less than the allowable State limit, however, is cause for concern. An engineering study is indicated in order to re-evaluate present operational procedures to improve the efficiency of this plant. In addition, provisions should be made to provide sufficient chlorination of the effluent in order to conform to State standards.

Although laboratory control at this plant appears to be quite good, the frequency of testing should be increased. Collection of 24-hour composite samples would also aid in a more complete understanding of plant performance.

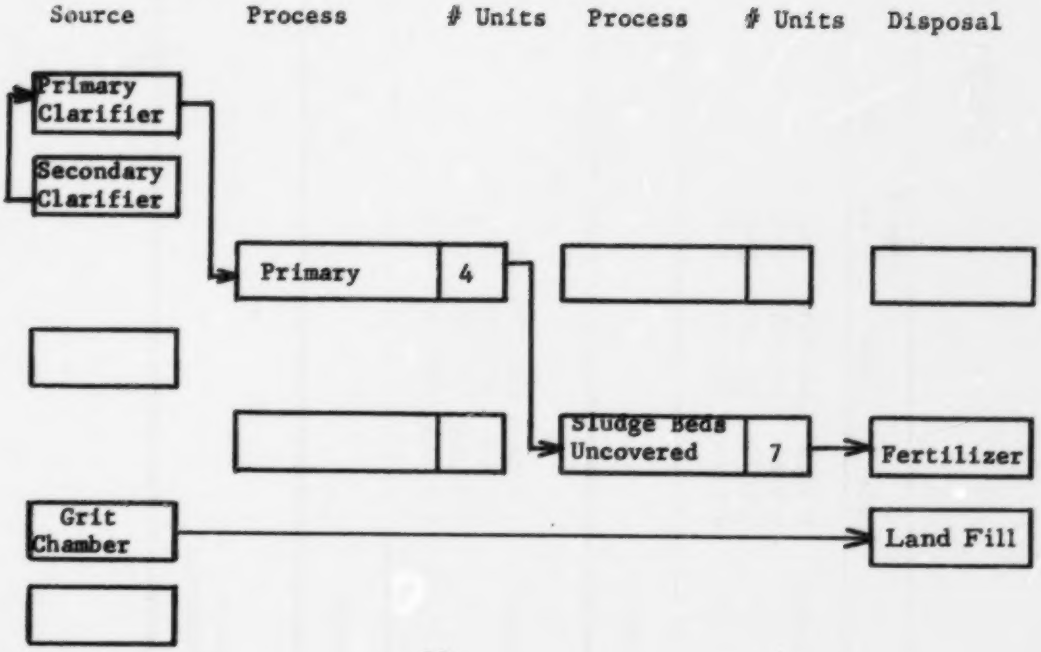
CITY OF ENGLEWOOD
FLOW DIAGRAM

Liquid Diagram



# Units	Process	Operation Description
2	Grit Removal	Flushed to River
2	Shredding	Barminutors
2	Metering	Parshall Flumes
2	Sedimentation	Primary
2	Filtration	
2	Sedimentation	Secondary
1	Chlorine Addition	
1	Chlorine Detention	Outfall to River
	Receiving Stream	South Platte River

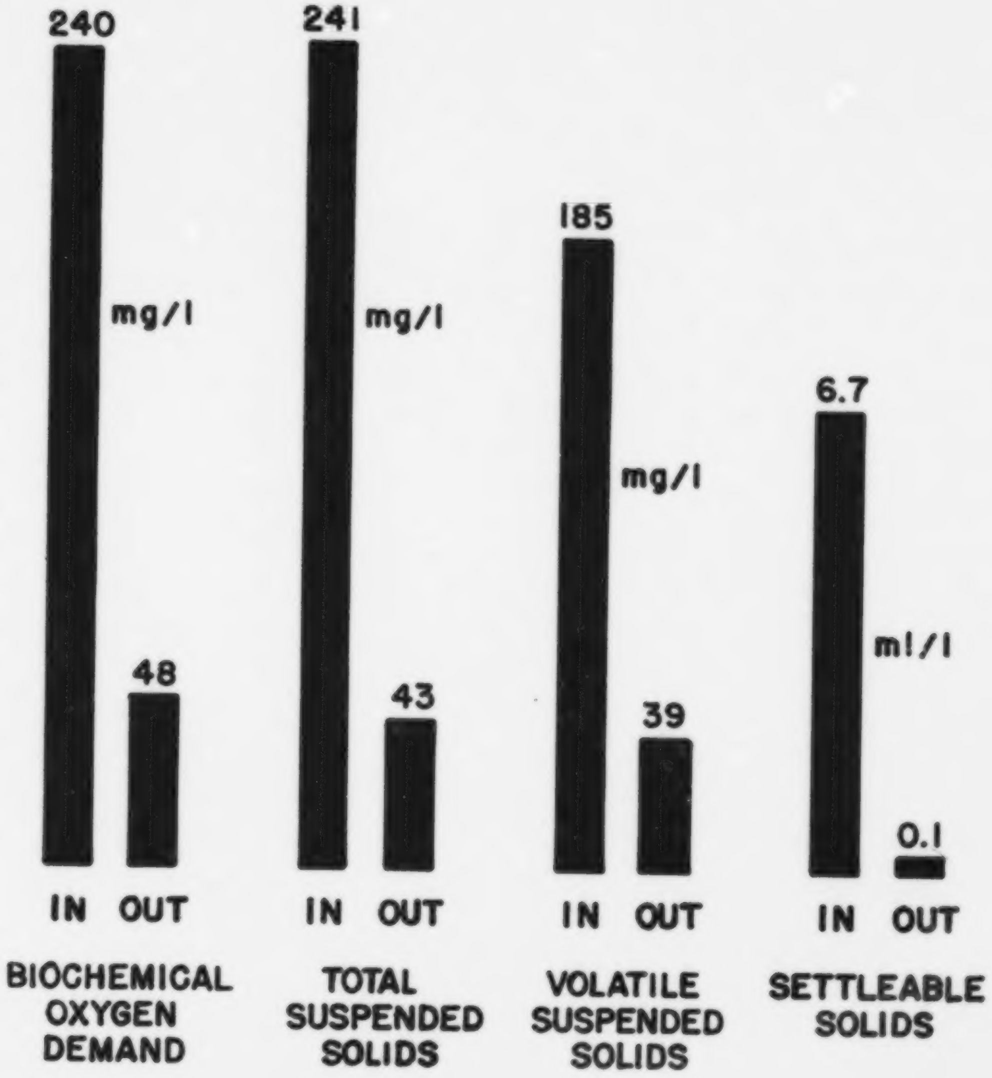
Solids Diagram


Source
Process
# Units
Process
# Units
Disposal
Primary Clarifier
Secondary Clarifier
Primary
4
Sludge Beds Uncovered
7
Fertilizer
Grit Chamber
Land Fill

ENGLEWOOD SEWAGE TREATMENT PLANT

	Date	Time	Sample Type	Temp	pH	BOD	TSS	VSS	Sett Solids	Cl_2Res	Total Coli	Fecal Coli
Effluent	9/8/64	8AM-3PM	C-8	--	--	49	44	42	<0.1	--	--	--
	9/9/64	8AM-3PM	C-8	--	--	48	36	36	0.1	--	--	--
	9/10/64	8AM-3PM	C-8	--	--	46	50	50	<0.1	--	--	--
	9/11/64	8AM-3PM	C-8	--	--	48	40	26	0.2	--	--	--
Average						48	43	39	0.1			
Influent	9/8/64	8AM-3PM	C-8	--	--	240	254	194	8.0	--	--	--
	9/9/64	8AM-3PM	C-8	--	--	250	258	205	7.5	--	--	--
	9/10/64	8AM-3PM	C-8	--	--	225	213	162	4.8	--	--	--
	9/11/64	8AM-3PM	C-8	--	--	245	238	177	6.5			
Average						240	241	185	6.7			
Percent Removals						80	82	79	99			

CITY OF ENGLEWOOD S.T.P.
PROJECT RECORD OF PLANT PERFORMANCE
1964



CITY OF LITTLETON

Type Treatment: Secondary

Population Served: 23,000 persons

Average Flow: 2.6 million gallons daily

Plant Capacity: 2.75 million gallons daily

Discussion:

The City of Littleton operates a complete secondary treatment facility located on the east bank of the South Platte River at its intersection with Bellevue Avenue (River mile 323.5). The original sewage treatment plant was constructed in 1949. The older facilities have now been abandoned and the plant capacity is based upon new units which were constructed in 1955 and 1959. One superintendent and four operators have been employed to operate this plant. In recent years, a substantial increase in ground-water infiltration has been noticed, and at the present time seems to be the most logical explanation for an average of 113 gallons per capita flow per day.

Effluent samples collected by the Colorado State Department of Public Health indicate that effluent quality discharge from this plant has an average biochemical oxygen demand of 35 mg/l. Samples collected and analyzed by Project personnel on December 16, 17, and 18, 1964 showed that the BOD was 43 mg/l. During the same sampling period, the influent quality was 235 mg/l BOD, for an average plant efficiency of 82 percent. Effluent quality expressed in terms of an equivalent population was 4,470 persons.

No chlorination facilities have been provided at this plant.

Laboratory equipment has been installed at this plant, and is used by the plant superintendent to determine both influent and effluent sewage quality. Tests which are performed are: BOD, weekly on the raw, primary effluent and final waste; suspended solids, weekly at the same point; settleable solids, weekly; suspended volatile solids on digester sludge, weekly; dissolved oxygen on the receiving stream weekly; pH of the digester, weekly; volatile acids occasionally; and alkalinity occasionally on the digester sludge. A complete record of plant performance is maintained by the plant superintendent.

Evaluation:

This plant consistently produces an effluent in conformance with current State standards for effluent discharges. However, present flows are rapidly approaching the capacity of the plant. An engineering study should be undertaken in the near future to determine a possible future plant expansion program. In addition, provisions should be made to provide sufficient chlorination of the effluent in order to conform to the State standards.

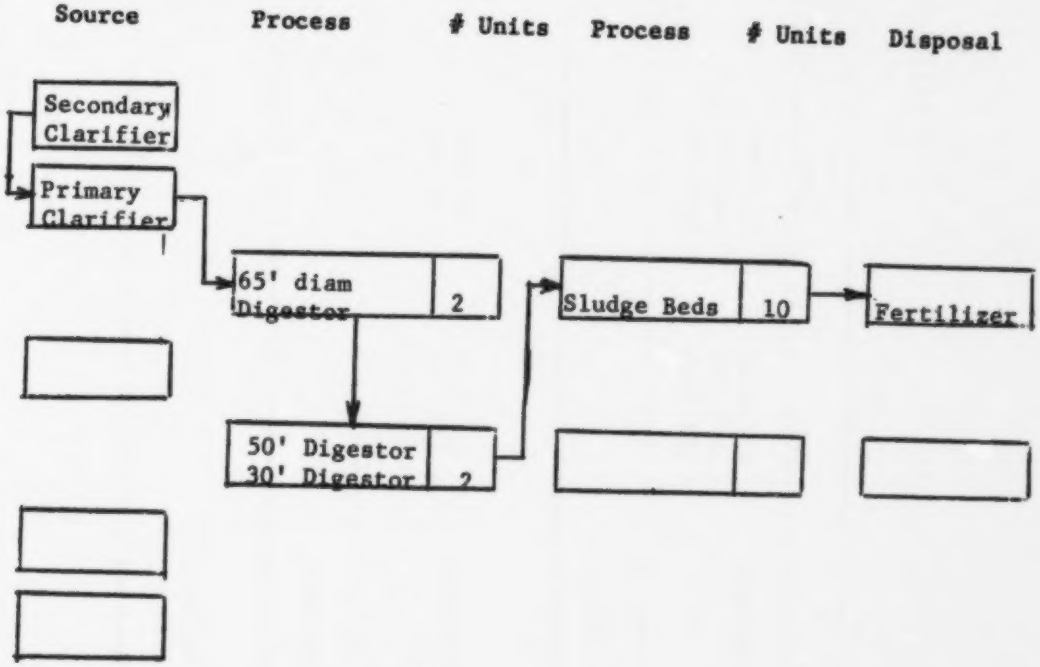
Although the operation control features practiced in this plant are generally good, an increased sampling program, based upon composite samples, should be included in the laboratory program of the plant.

CITY OF LITTLETON
FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	Grit Removal	
1	Shredding	Barminutor
1	Sedimentation	80' Diameter (Primary)
2	Filtration	110' diam; 100' diam.
1	Sedimentation	105' Diam.
	Receiving Stream	South Platte River

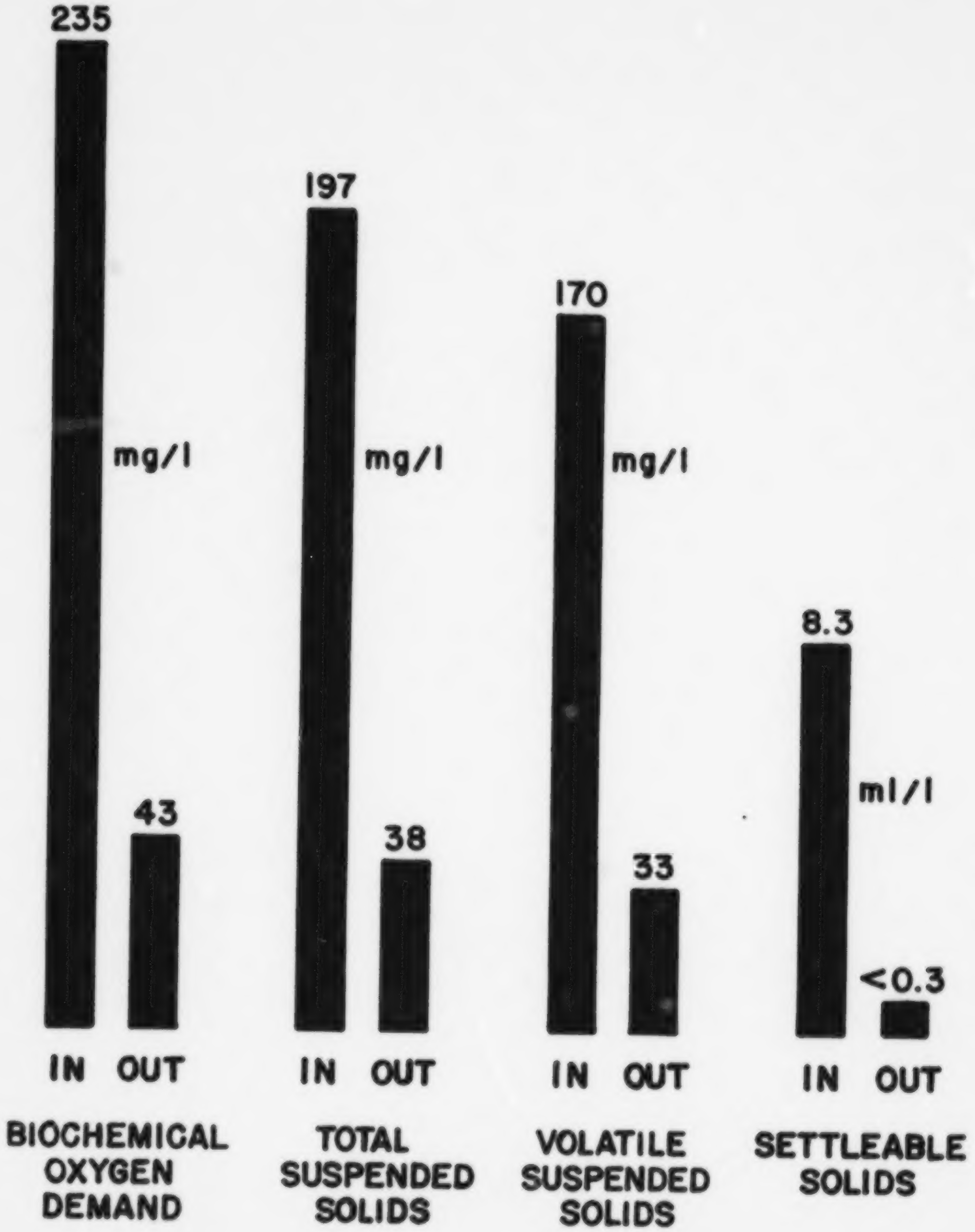
Solids Diagram


Source
Process
# Units
Process
# Units
Disposal
Secondary Clarifier
Primary Clarifier
65' diam Digestor
2
50' Digestor
30' Digestor
2
Sludge Beds
10
Fertilizer

LITTLETON SEWAGE TREATMENT PLANT

	Date	Time	Sample Type	BOD	TSS	VSS	Settleable Solids
Effluent	12/16/64	8AM-3PM	C	49	52	48	0.6
	12/17/64	8AM-3PM	C	37	29	22	<0.1
	12/18/64	8AM-3PM	C	44	32	29	0.1
Average				43	38	33	<0.26
Influent	12/16/64	8AM-3PM	C	240	163	143	7.5
	12/17/64	8AM-3PM	C	230	221	192	7.5
	12/18/64	8AM-3PM	C	--	206	174	10.0
Average				235	197	170	8.3
Percent Removals				82	81	81	97

CITY OF LITTLETON S. T. P.
PROJECT RECORD OF PLANT PERFORMANCE
1964



BAKER WATER AND SANITATION DISTRICT

Type Treatment:	Secondary
Population Served:	17,500 persons
Average Flow:	1.5 million gallons daily
Plant Capacity:	1.0 million gallons daily

Discussion:

The Baker Water and Sanitation District operates a sewage treatment plant located adjacent to Clear Creek at its intersection with Pecos Avenue (River mile 305.5/3.0). One man is employed by the Sanitation District to operate this plant for a period of 8 hours per day during weekdays only. During periods of high flow, usually during the mid-day period, a portion of the sewage is bypassed because of insufficient plant capacity.

Colorado State Department of Public Health sampling results for the years 1961, 1962 and 1963 indicate that the quality of effluent discharged in terms of BOD, was 270 mg/l, 148 mg/l and 126 mg/l for the years, respectively. Samples collected and analyzed by Project personnel during the period April 15 through April 17, 1964, determined that average effluent discharge, including by-passed sewage, was 150 mg/l BOD. During the same Project sampling period, the influent BOD was 265 mg/l BOD, for an average plant efficiency of 43 percent. The effluent quality expressed in terms of an equivalent population was 10,300 persons.

No chlorination facilities have been provided at this plant.

Until recently, very little of the available laboratory equipment was being used. However, during the past several months the operator has undertaken a sampling and testing program which should provide a complete record of plant performance in the future. A daily flow log and other pertinent factors of operation is maintained by the operator.

Evaluation:

The effluent quality of 150 mg/l is far in excess of the allowable State standards. Furthermore the bacterial density of the effluent was determined during Project sampling at 9.7×10^6 coliform per 100 ml, 97 times the allowable State standard of 1.0×10^5 coliforms per 100 mls. Present flows also are much greater than the plant capacity. Inasmuch as this plant is committed to membership in the Metropolitan Denver Sewage Disposal District No. 1, the discharge will be limited to 30 mg/l BOD as of January 1, 1967.

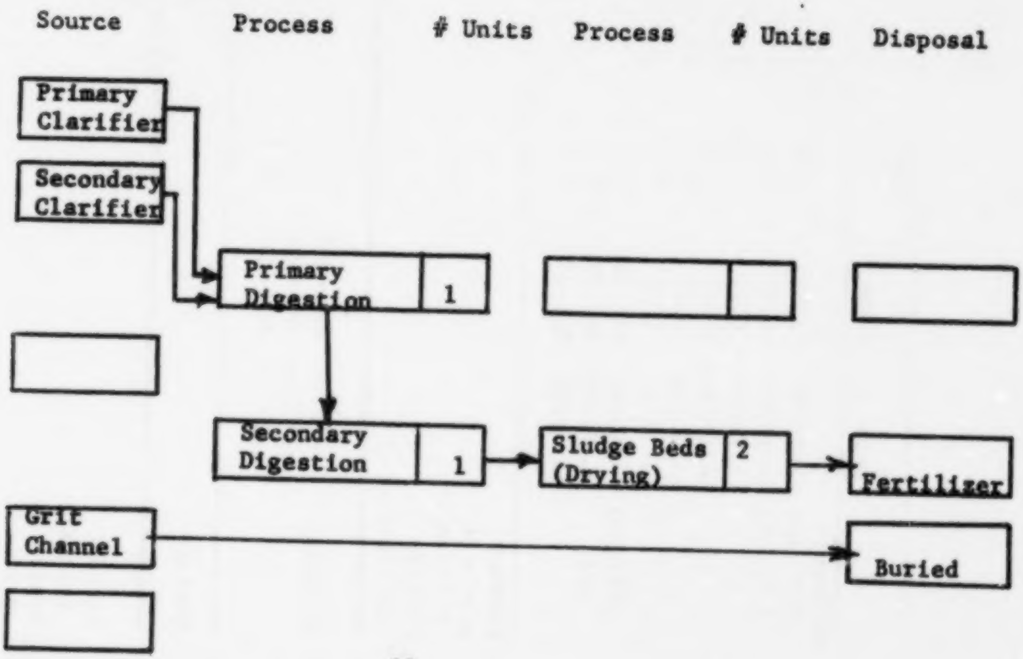
At the present time, the operation control features practiced by the operator at this plant are not in conformity with the recommended minimum standards as adopted by the Conference of State Sanitary Engineers. In addition, a plant of this size should employ at least two operators and one laborer.

BAKER STP
FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	**Metering**	**Parshall Flume - Recording**
2	**Grit Removal**	**Handcleaned Chamber**
1	**Shredding**	**Comminutor**
1	**Sedimentation**	**Rectangular (Primary)**
1	**Filtration**	**High Rate Trickling Filter**
1	**Sedimentation**	**Rectangular (Secondary)**
	Receiving Stream	**Clear Creek**

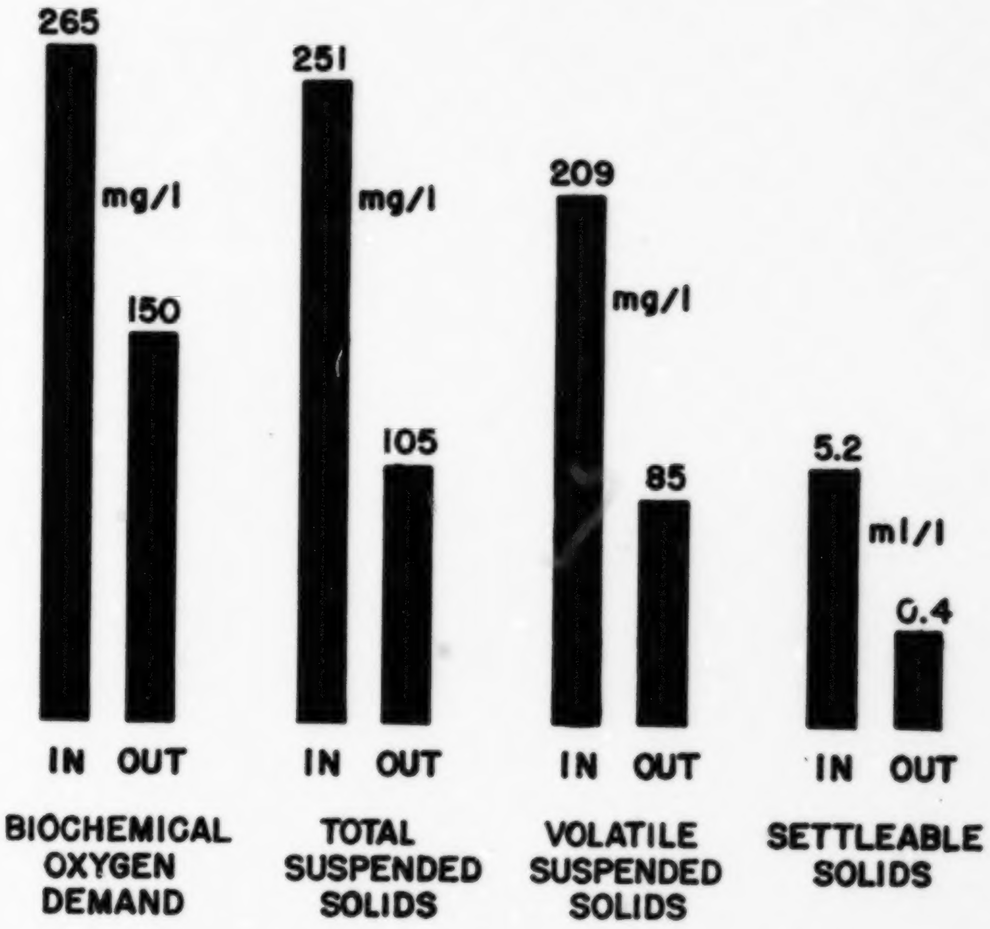
Solids Diagram


Source
Process
# Units
Process
# Units
Disposal
Primary Clarifier
Secondary Clarifier
Primary Digestion
1
Secondary Digestion
1
Sludge Beds (Drying)
2
Fertilizer
Grit Channel
Buried

BAKER SEWAGE TREATMENT PLANT

	Date	Time	Sample Type	Temp	pH	BOD	TSS	VSS	Sett Solids	Cl_2Res	Total Coli .	Fecal mColi
Effluent												
Effluent + Bypass	(4/15/64	1135	Grab	15.0	7.6	185	123	99	1.2	--	$17.2x10^6$	$3.3x10^6$
	(4/15/64	1445	Grab	19.0	6.8	140	87	69	0.6	--	$22.1x10^6$	$10.9x10^6$
	(4/16/64	1300	Grab	18.0	7.8	135	88	76	0.5	--	$7.9x10^6$	$4.9x10^6$
	(4/16/64	1545	Grab	19.0	7.5	170	93	65	0.1	--	$4.9x10^6$	$2.2x10^6$
	(4/17/64	0900	Grab	14.0	8.0	105	136	120	$<$ 0.1	--	$2.4x10^6$	$3.3x10^6$
	(4/17/64	1030	Grab	14.5	7.4	155	--	--	$<$ 0.1	--	$2.4x10^7$	$1.3x10^7$
Effluent only	(4/15/64	8AM-3PM	C-8	--	--	140	136	135	$<$ 0.1	--	--	--
	(4/16/64	8AM-3PM	C-8	--	--	83	44	32	0	--	--	--
	(4/17/64	8AM-3PM	C-8	--	--	65	106	96	0	--	--	--
Average Bypass + Effluent					7.5	150	105	85	0.4	--	$9.7x10^6$	$5.1x10^6$
Average Effluent only						96	95	88	$<$ 0.1			
Influent	4/15/64	8AM-3PM	C-8	--	--	215	214	164	2.5	--	--	--
	4/16/64	8AM-3PM	C-8	--	--	305	208	174	6.5	--	--	--
	4/17/64	8AM-3PM	C-8	--	--	270	332	289	6.5	--	--	---
Average						265	251	209	5.2			
Percent Removals												
Bypass + Effluent						43	58	59	92			
Effluent only						64	62	58	98			

BAKER S.T.P.
PROJECT RECORD OF PLANT PERFORMANCE
1964



CITY OF WESTMINSTER

Type Treatment: Primary

Population Served: 17,500 persons

Average Flow: 1.3 million gallons daily

Plant Capacity: 1.25 million gallons daily

Discussion:

The City of Westminster operates a treatment plant adjacent to Lowell Boulevard. The plant effluent flows down a dry wash to Clear Creek, at approximately Pecos Street (River mile 305.5/3.6). Although the plant facilities include trickling filters, those facilities are presently being bypassed. The plant provides only primary treatment. Two operators are employed a total of 80 hours per week to operate this facility. In addition to these men, the City Engineer spends approximately 10 hours per week supervising the operation.

Colorado State Department of Public Health sampling programs at this plant have shown increasing deterioration of the effluent quality over the past 4 years. In 1960, the average biochemical oxygen demand of the plant effluent was 204 mg/l; by 1963, effluent quality was 320 mg/l BOD. Results obtained in the course of the Project sampling program during the period April 15 through April 17, 1964 indicated a BOD value for effluent discharge as 335 mg/l. At the same time, the BOD influent quality was 345 mg/l, providing an average plant efficiency of 3 percent. Based upon these sampling results, it was determined that the effluent quality in terms of an equivalent population was 18,900 persons.

Although chlorination facilities have been installed at this plant, they are not presently in use.

A laboratory has been provided, but these facilities are not used at the present time. The flow metering device has not worked for some time, so that there is no record of the volume of sewage handled by this plant.

Evaluation:

The quality of effluent discharged from this plant is far in excess of the current allowable State standards. Plant capacity is exceeded on an average daily basis and it is clear that this plant cannot adequately handle present loads. Inasmuch as this plant is already committed to membership in the Metropolitan Denver Sewage Disposal District No. 1, discharge to Clear Creek will be limited to the allowable state standards, with the excess being diverted to the new MDSDD#1 treatment facilities. During the interim period, however, there is no question that the operation of this plant requires immediate attention. Such services as are required for an immediate study can be provided by Colorado State Department of Public Health.

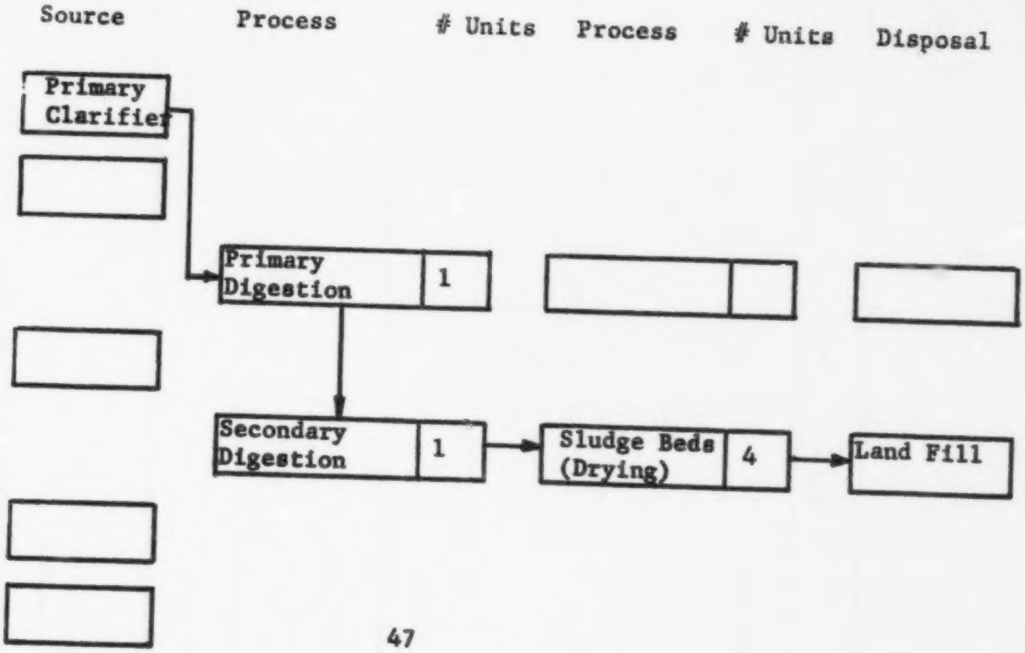
For a plant of this size and degree of treatment, the Conference of State Sanitary Engineers recommended that the following tests be performed by plant personnel: 1) settleable solids daily; 2) relative stability daily; 3) BODs of raw waste and final effluent at least once a week and preferably twice a week; 4) suspended solids of raw waste and final effluent at least once a week and preferably twice a week; 5) pH of digested sludge when drawn; 6) total solids of digested sludge when drawn; 7) DO of receiving stream at least twice per week above and below the plant discharge; and of chlorine residuals of the effluent daily. Furthermore, the State Sanitary Engineers stated that considerable care and technical supervision competence is required in the recording of plant data. All features of plant operation should be improved before January 1, 1967.

CITY OF WESTMINSTER STP
FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	Measuring	Parshall Flume
2	Grit Removal	Hand Cleaned Chambers
1	Shredding	Comminutor
1	Sedimentation	Circular (Primary)
2	Filtration	Abandoned Trickling Filters
1	Sedimentation	Circular (Secondary) Abandoned
1	Chlorine Addition	Not Used
	Receiving Stream	Clear Creek

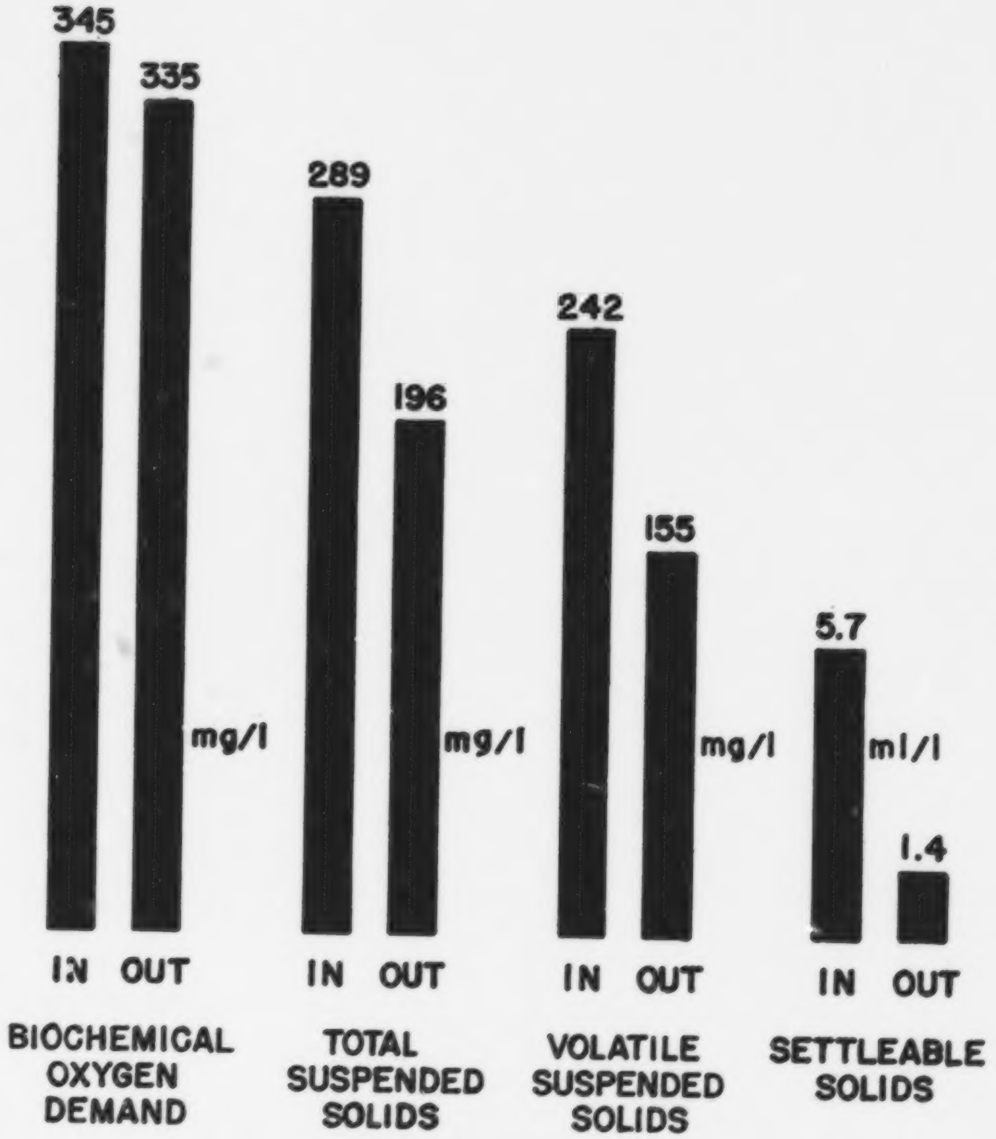
Solids Diagram


Source
Process
# Units
Process
# Units
Disposal
Primary Clarifier
Primary Digestion
1
Secondary Digestion
1
Sludge Beds (Drying)
4
Land Fill

WESTMINSTER SEWAGE TREATMENT PLANT

	Date	Time	Sample Type	Temp	pH	BOD	TSS	VSS	Sett Solids	CL_2Res	Total Coli	Fecal Coli
Effluent	4/15/64	1250	Grab	13.0	7.1	380	260	199	1.5	--	$22.1x10^{7}$	$4.9x10^{7}$
	4/15/64	1455	Grab	--	7.0	330	196	154	1.4	--	$1.3x10^{7}$	$4.9x10^{6}$
	4/16/64	1310	Grab	16.5	7.3	510	276	208	2.5	--	$6.3x10^{6}$	$4.6x10^{6}$
	4/16/64	1540	Grab	16.5	7.1	290	146	118	0.5	--	$5.6x10^{8}$	$2.2x10^{8}$
	4/17/64	0910	Grab	13.0	7.1	160	188	156	1.8	--	$22.1x10^{6}$	$3.3x10^{6}$
	4/17/64	1040	Grab	13.5	7.4	330	168	134	1.7	--	$10.9x10^{6}$	$4.9x10^{6}$
	4/15/64	8AM-3PM	C-8	--	--	350	174	134	1.0	--	--	--
	4/16/64	8AM-3PM	C-8	--	--	295	164	138	1.5	--	--	--
	4/17/64	8AM-3PM	C-8	--	--	350	--	--	1.0	--	--	--
Average					7.2	335	196	155	1.4		$3.7x10^{7}$	$1.3x10^{7}$
Influent	4/15/64	8AM-3PM	C-8	--	--	365	235	181	5.0	--	--	--
	4/16/64	8AM-3PM	C-8	--	--	355	238	206	5.5	--	--	--
	4/17/64	8AM-3PM	C-8	--	--	310	393	338	6.5	--	--	--
Average						345	289	242	5.7			
Percent Removals						3	32	36	75			

CITY OF WESTMINSTER S.T.P.
PROJECT RECORD OF PLANT PERFORMANCE
1964



CITY OF ARVADA

Type Treatment: Secondary

Population Served: 36,000 persons

Average Flow: 3.5 million gallons daily

Plant capacity: .75 million gallons daily

Discussion:

The City of Arvada operates a sewage treatment plant which is located near Ralston Creek at its intersection with 56th Avenue, (River mile 305.5/6.2/0.3). Although the City of Arvada has a tributary population of 36,000 persons with an average daily flow of 3.5 million gallons, this standard trickling filter plant processes approximately one-third of the sewage load. The remaining two-thirds of the daily flow, in the amount of 2.4 million gallons, is bypassed directly to Clear Creek without treatment. One operator and one laborer are employed by the City of Arvada to maintain the plant. Effluent from the plant is conveyed via the new Metropolitan Denver Sewage Disposal District No. 1 Clear Creek interceptor to a point of discharge on Clear Creek approximately one-tenth of a mile east of Federal Boulevard (River mile 305.5/4.6). The 2.4 million gallons daily raw sewage bypass is also discharged to Clear Creek at this point.

Colorado State Department of Public Health data for the year 1962 shows that the effluent discharge from the City of Arvada sewage treatment plant had a biochemical oxygen demand of 75 mg/l. In 1963, the corresponding value for BOD was 63 mg/l. Samples collected and analyzed by Project personnel during the period May 13 to May 15 indicate that the average effluent discharged from the Arvada Sewage treatment plant was 63 mg/l BOD. Samples collected by Project personnel during the period December 16 through December 18, 1964 indicated that the combined discharge to Clear Creek at Federal Boulevard for plant effluent and bypass flow had a biochemical oxygen demand of 210 mg/l. In order to determine treatment efficiency, influent samples were collected at the Arvada sewage treatment plant during the period May 13 through May 15. Influent sewage had a strength of 280 mg/l, giving a percentage plant efficiency of 78 percent based on plant flows. However, using the figure of 210 mg/l BOD of the combined discharge to Clear Creek, the average efficiency of treatment of all sewage collected was 25 percent. Population equivalent of all sewage discharged to Clear Creek from Arvada has been determined to be 29,700 persons.

There are no chlorination facilities at the City of Arvada sewage treatment plant.

A limited amount of laboratory equipment is available to plant personnel; however, no tests are performed. Record of plant operation is limited to keeping of flow records.

Evaluation:

Pollutional loading from the City of Arvada is far in excess of the allowable State standards. The present .75 mgd capacity of the Arvada sewage treatment plant is considerably exceeded by the average flows of 3.5 million gallons daily. Inasmuch as the City of Arvada is committed to membership in the Metropolitan Denver Sewage Disposal District No. 1, discharge to Clear Creek after January 1, 1967 will be limited to an effluent quality of 30 mg/l. Chlorination facilities should be installed at the plant to provide disinfection of the effluent. In addition, temporary chlorination facilities should be utilized to reduce bacterial density discharges to Clear Creek at the point of raw sewage discharge.

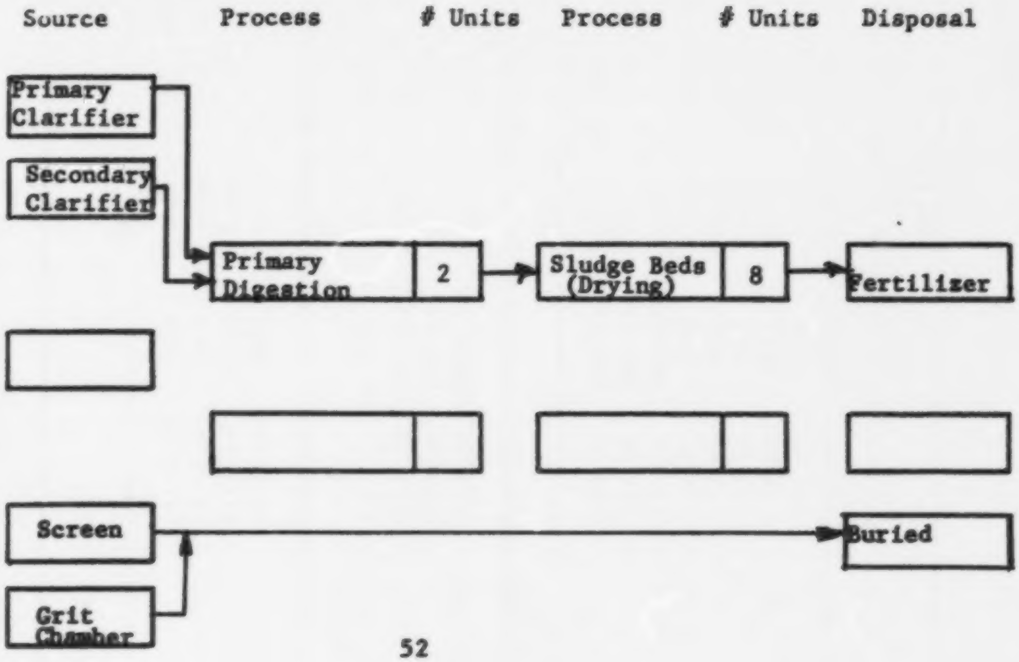
The "Recommendations for Minimum Personnel, Laboratory Control, and Records" provides that at least two operators, one laborer and a minimum of six hours per week of administrative supervision be provided for a plant of this size and complexity. Furthermore, the following laboratory tests should be run: 1) settleable solids daily; 2) relative stability daily; 3) BOD of raw waste and final effluent at least once per week and preferably twice a week; 4) suspended solids of raw waste and final effluent at least once per week and preferably twice a week; 5) pH of digested sludge when drawn; 6) total solids of digested sludge when drawn; 7) DO of receiving stream at least twice a week, above and below the plant discharge; 8) chlorine residuals of effluent daily. In addition to this, complete records of the operation and laboratory control should be maintained. Should this plant continue to operate, it is desirable that minimum recommendations as outlined above should be maintained.

CITY OF ARVADA
FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	Measuring	Parshall Flume (Recording)
1	Screening	Hand Cleaned Bar Screen
2	Grit Removal	Hand Cleaned Chambers
1	Shredding	Comminutor
1	Sedimentation	Circular (Primary)
1	Filtration	High Rate Trickling Filter
1	Sedimentation	Circular (Primary)
	Receiving Stream	Clear Creek

Solids Diagram

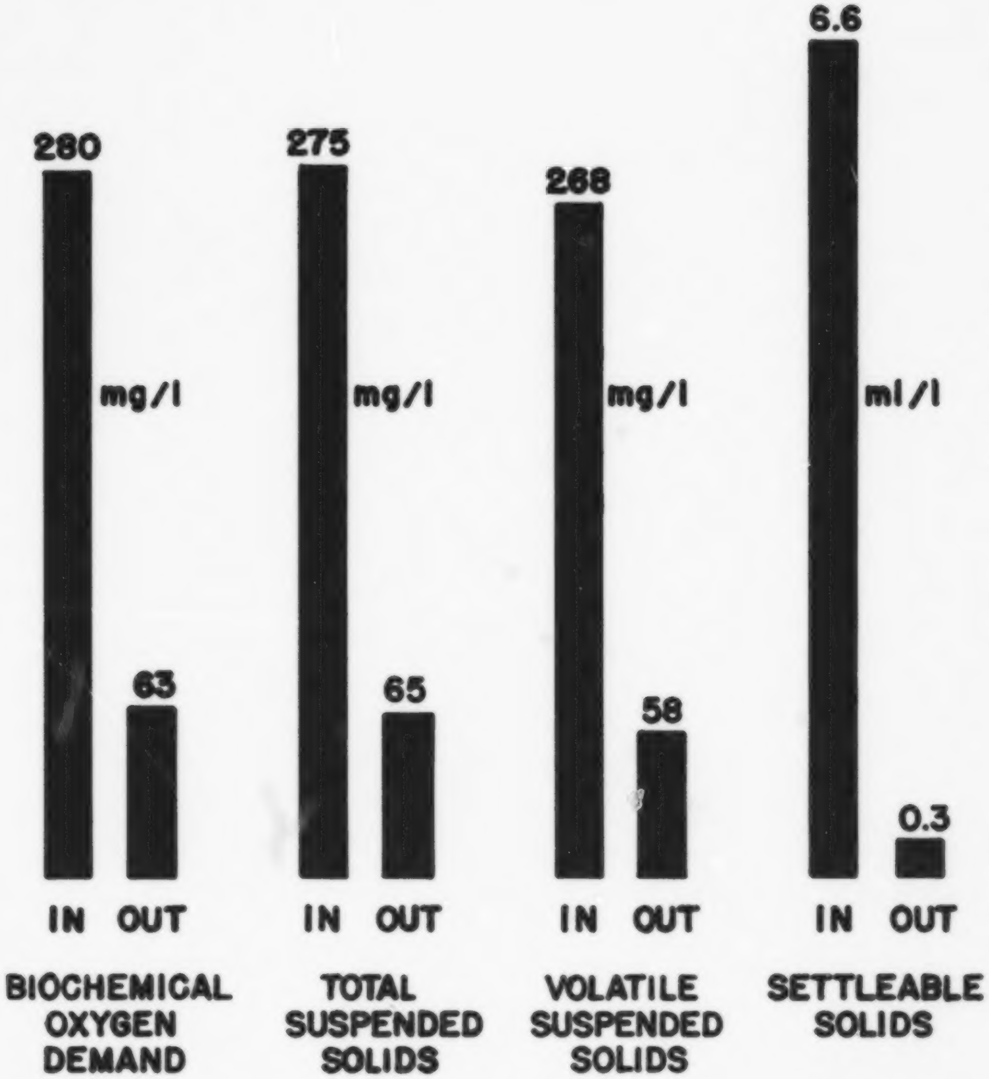

Source
Process
# Units
Process
# Units
Disposal
Primary Clarifier
Secondary Clarifier
Primary Digestion
2
Sludge Beds (Drying)
8
Fertilizer
Screen
Grit Chamber
Buried

ARVADA SEWAGE TREATMENT PLANT

	Date	Time	Sample Type	Temp	pH	BOD	TSS	VSS	Sett Solids	Cl_2Res	Total Coli	Fecal Coli
Effluent	5/13/64	0835	Grab	15.0	7.5	28	18	18	0.2	--	$7.9x10^6$	$3.3x10^5$
	5/13/64	1100	Grab	17.0	7.7	77	--	--	0.6	--	$7.0x10^6$	$1.3x10^6$
	5/14/64	0925	Grab	15.5	7.7	40	59	56	< .1	--	$2.3x10^6$	$7.9x10^5$
	5/14/64	1240	Grab	17.5	7.6	70	89	84	.2	--	$4.9x10^6$	$2.2x10^6$
	5/15/64	1230	Grab	18.5	6.9	71	95	95	0.3	--	$1.3x10^7$	$3.3x10^6$
	5/15/64	1420	Grab	18.5	6.9	69	65	61	0.5	--	$2.4x10^7$	$4.9x10^6$
	5/13/64	8AM-3PM	C-8	--	--	73	51	34	0.4	--	--	--
	5/14/64	8AM-3PM	C-8	--	--	63	--	--	0.2	--	--	--
	5/15/64	8AM-3PM	C-8	--	--	79	79	58	0.2	--	--	--
Average					7.4	63*	65*	58*	< 0.3*		$7.6x10^6$*	$1.5x10^6$
Influent	5/13/64	8AM-3PM	C-8	--	--	--	341	301	7.3			
	5/14/64	8AM-3PM	C-8	--	--	300	254	254	7.0			
	5/15/64	8AM-3PM	C-8	--	--	260	290	248	5.5			
Average						280	275	268	6.6			
Bypass to Clear Creek	12/16/64	0845	Grab	--	--	124	201	189	0.3	--	--	--
	12/16/64	0920	Grab	--	--	200	775	748	0.5	--	--	--
	12/18/64	1005	Grab	--	--	295	570	527	9.5	--	--	--
	12/18/64	1035	Grab	--	--	300	327	288	8.0	--	--	--
Average						230	470	440	4.6			

*Not including effect of bypassed sewage

CITY OF ARVADA S.T.P.
PROJECT RECORD OF PLANT PERFORMANCE
1964



CLEAR CREEK VALLEY SANITATION DISTRICT

Type Treatment:	Secondary
Population Served:	7,000 persons
Average Flow:	1.5 million gallons daily
Plant Capacity:	.85 million gallons daily

Discussion:

The Clear Creek Valley Sanitation District operates a secondary sewage treatment plant located adjacent to Clear Creek slightly west of Sheridan Boulevard (River mile 305.7/7.0). This standard high-rate trickling filter plant is operated by one man with supervision provided by the secretary of the district. The plant is not attended over the weekend days. A significant portion of the flows received by the Clear Creek Valley Sanitation District plant originate at a packinghouse located approximately 500 yards from the plant. Average BOD of the effluent discharge from the packinghouse operation during the 5-day sampling period in 1962 indicates that the quality of sewage discharged by the packinghouse is 2400 mg/1 BOD.

Colorado State Department of Public Health data for the year 1963 indicates that the average effluent discharge quality was 310 mg/1 BOD. Samples collected and analyzed by Project personnel during the period May 13 through May 15, 1964 determined effluent quality to be 285 mg/1 BOD. Influent quality during this period was 865 mg/1 BOD. Treatment provided by this plant, based upon influent and effluent values obtained by Project personnel was 67 percent. Effluent quality expressed in terms of an equivalent population is 10,600 persons.

Chlorination facilities have been provided at the plant but are not presently in use.

There are no laboratory facilities available at this plant. No records of operation are maintained.

Evaluation:

Compared to the effluent discharge standard of 30 mg/1 provided by State statutes along Clear Creek, effluent discharge from this plant is far in excess of allowable. Furthermore, the plant capacity is exceeded daily by approximately 500,000 gallons. Future flows and loadings can only serve to deteriorate the plant effluent to an even greater extent than at present. The District has made application to the Metropolitan Denver Sewage Disposal

District No. 1 for a feasibility estimate to be prepared. If the decision is made to maintain the present plant and not to join Metro, major plant expansion will be necessary to handle future loading.

This plant is not in conformance with the "Recommendations for Minimum Personnel, Laboratory Control, and Records," as adopted by the Conference of State Sanitary Engineers. For a plant of this size and degree of treatment, at least 6 hours a week of administrative supervision, two operators and one laborer should be provided.

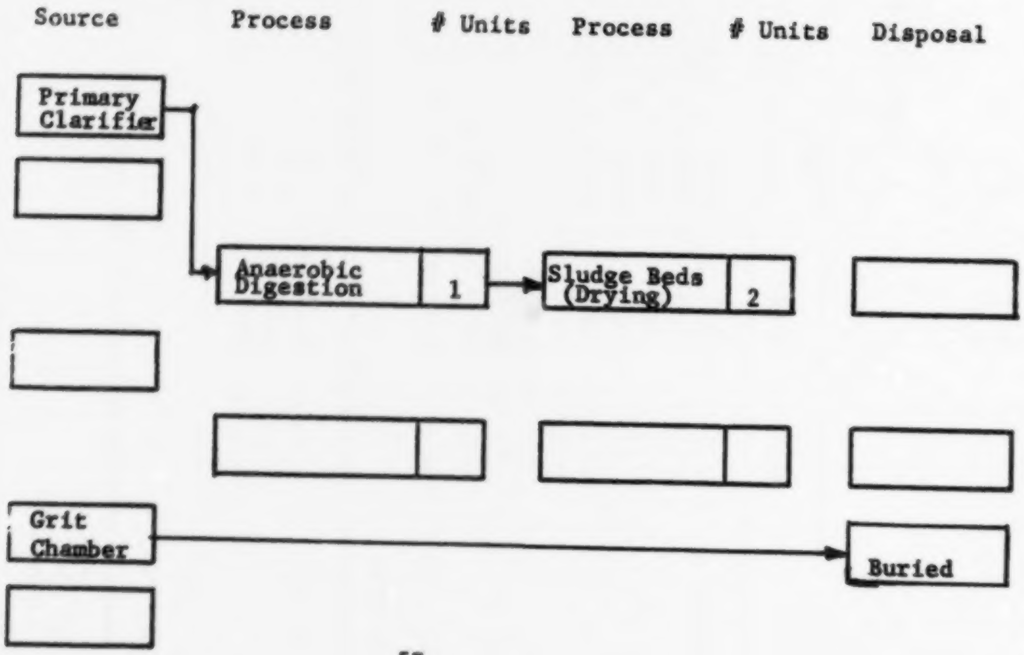
Furthermore, laboratory control should include the following tests: 1) settleable solids daily; 2) relative stability, daily; 3) BODs of raw waste and final effluent, once a week, preferably twice a week; 4) suspended solids of raw waste and final effluent, once a week, preferably twice a week; 5) pH of digested sludge when drawn; 6) total solids of digested sludge when drawn; 7) DO of receiving stream both above and below the plant, at least twice a week; 8) chlorine residual of effluent daily. Included in the plant records in addition to a record of the laboratory control tests should be such items as flow, grit removed, sludge withdrawn, gas production, and other pertinent factors of plant operation.

CLEAR CREEK VALLEY STP
FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	Metering	Parshall Flume
2	Grit Removal	Hand-cleaned Chambers
1	Sedimentation	Rectangular (Primary)
1	Filtration	High-rate Trickling Filter
1	Sedimentation	Circular (Secondary)
1	Chlorine Addition	Not in use
	Receiving Stream	Clear Creek

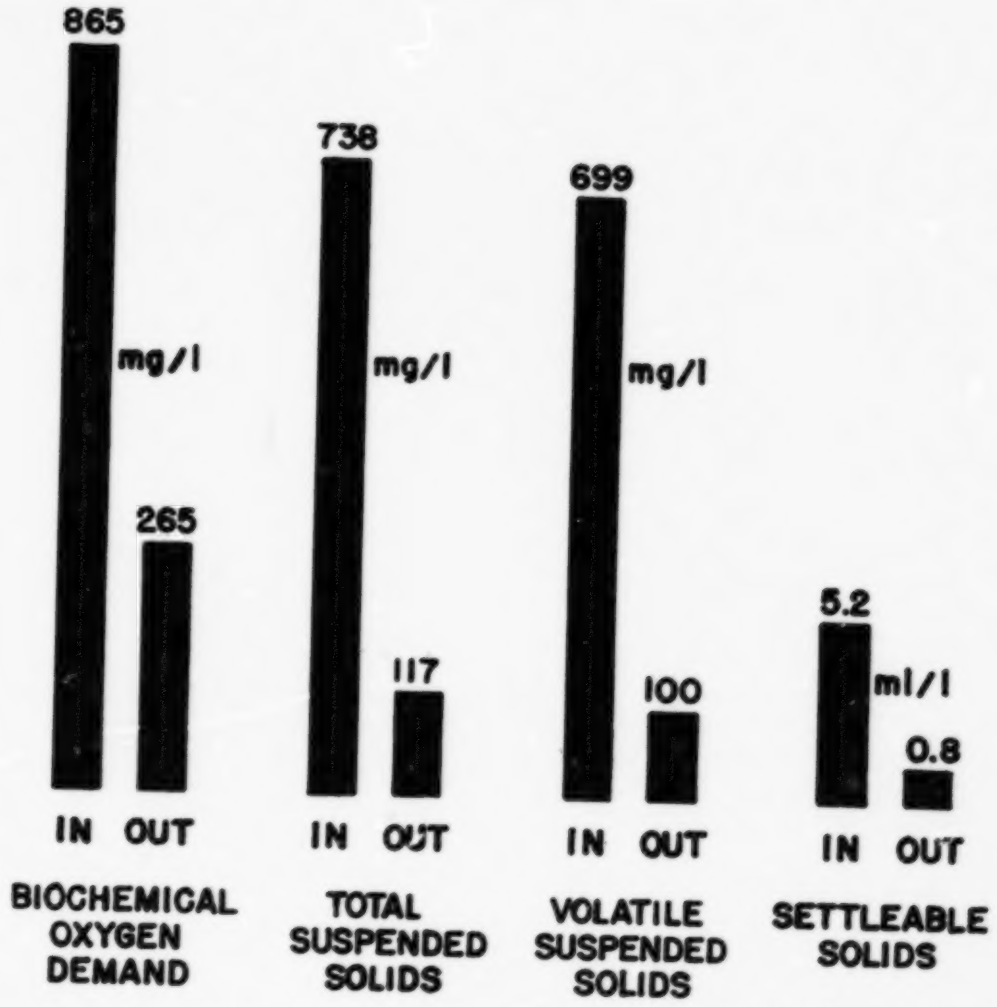
Solids Diagram


Source
Process
# Units
Process
# Units
Disposal
Primary Clarifier
Anaerobic Digestion
1
Sludge Beds (Drying)
2
Grit Chamber
Buried

CLEAR CREEK VALLEY SEWAGE TREATMENT PLANT

	Date	Time	Sample Type	Temp	pH	BOD	TSS	VSS	Sett Solids	Cl_2Res	Total Coli	Fecal Coli
Effluent	5/13/64	0815	Grab	16.5	7.3	185	38	24	1.0	--	$7.0x10^6$	$2.3x10^6$
	5/13/64	1055	Grab	18.0	7.3	295	129	117	1.0	--	$1.3x10^7$	$3.3x10^6$
	5/14/64	0915	Grab	17.5	7.5	215	97	94	0.8	--	$7.0x10^6$	$2.4x10^6$
	5/14/64	1230	Grab	18.5	7.3	425	--	--	0.8	--	$4.9x10^6$	$4.6x10^6$
	5/15/64	1235	Grab	19.5	7.2	335	47	43	0.8	--	$1.3x10^7$	$3.3x10^6$
	5/15/64	1425	Grab	20.5	7.0	225	184	165	1.5	--	$7.9x10^6$	$3.3x10^6$
	5/13/64	8AM-3PM	C-8	--	--	295	122	122	0.5	--	--	--
	5/14/64	8AM-3PM	C-8	--	--	300	160	--	0.6	--	--	--
	5/15/64	8AM-3PM	C-8	--	--	270	160	136	0.3	--	--	--
Average					7.3	285	117	100	0.8	--	$8.3x10^6$	$3.1x10^6$
Influent	5/13/64	8AM-3PM	C-8	--	--	860	572	520	6.5	--	--	--
	5/14/64	8AM-3PM	C-8	--	--	990	1118	1092	4.5	--	--	--
	5/15/64	8AM-3PM	C-8	--	--	750	523	484	4.5	--	--	--
Average						865	738	699	5.2			
Percent Removals						67	84	86	85			

CLEAR CREEK VALLEY S.T.P.
PROJECT RECORD OF PLANT PERFORMANCE
1964



WHEATRIDGE SANITATION DISTRICT

Type Treatment: Secondary

Population Served: 20,500 persons

Average Flow: 1.8 million gallons daily

Plant Capacity: 1.75 million gallons daily

Discussion:

The Wheatridge Sanitation District operates a standard trickling filter secondary plant which discharges to Clear Creek at its intersection with Marshall Road (River mile 305.5/7.5). A total of five persons are employed to maintain this facility during the daylight hours.

Colorado State Department of Public Health Data for the years 1959 through 1963 indicates that the quality of effluent discharged from this plant has been slightly below 50 mg/1 biochemical oxygen demand. Samples collected and analyzed by Project personnel during the period December 16 through December 18 indicate that the effluent discharged during the period of sampling had a BOD of 95 mg/1, based upon 8-hour composite samples. During the same Project sampling period the influent BOD was determined at 355 mg/1 BOD. The average plant reduction efficiency was 73 percent. The effluent quality expressed in terms of population equivalent was 7,560.

Chlorination facilities have been provided at the plant and are used to chlorinate the effluent. Chlorine detention time is provided in the outfall line to Clear Creek. A trace of chlorine residual has been noted in the effluent discharged to the Creek.

A limited amount of sampling equipment and laboratory testing equipment is used by the plant personnel to determine sewage quality. Imhoff cones for the settleable solids test and a Beckman pH meter are the only items of laboratory equipment which were noted by Project personnel during the inspection of the plant. The plant superintendent relies upon a commercial laboratory to determine the parameters of sewage quality being discharged to Clear Creek. A complete record of the laboratory tests performed by this commercial laboratory is kept on file by the plant superintendent as well as other information including flows and a record of routine operation maintenance procedures.

Evaluation:

Colorado State Department of Public Health data for the years 1959-1961 to 1963 indicate that the effluent discharge from this plant has been in excess of the allowable State standard of 30 mg/l BOD for discharge to a receiving stream with a downstream municipal water use. Project sampling further substantiates that this plant is in violation of State standards. Inasmuch as this plant is committed to membership in Metropolitan Denver Sewage Disposal District No. 1, effluent discharge from the plant will be limited to a quality in conformance with State standards by January 1, 1967.

Operation of this plant is considered good; however, it is still not in conformance with "Minimum Standards" as prepared by the Conference of State Sanitary Engineers. In the interim period until the new Metro facilities can be constructed, it is advisable that this plant increase the frequency of laboratory testing and consider the use of 8-hour composite samples to determine the quality of sewage being treated.

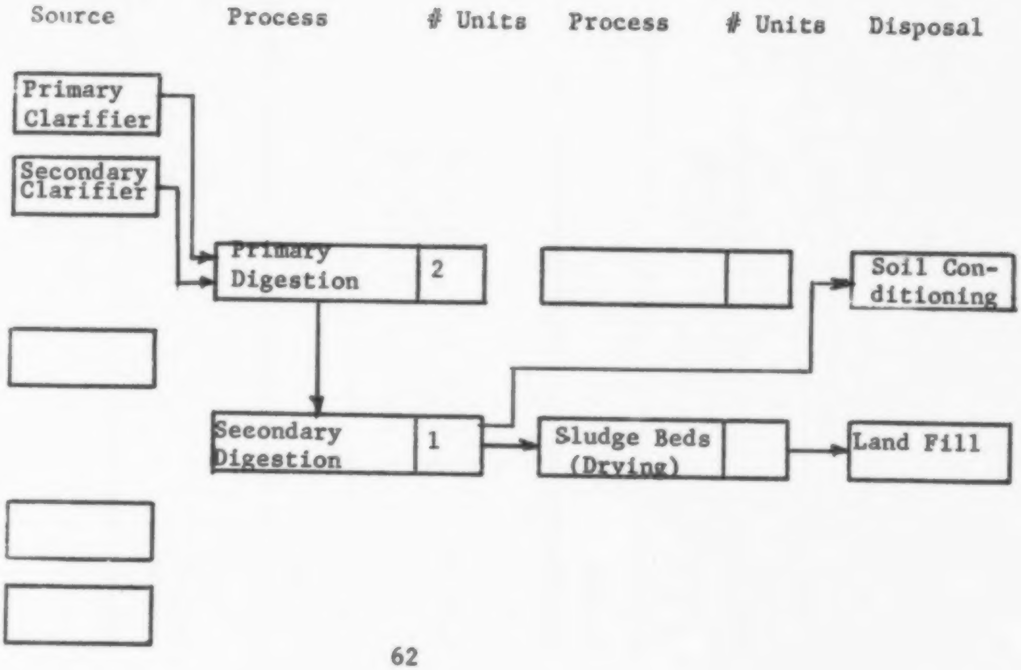
WHEATRIDGE STP

FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	Metering	Parshall Flume (Recording)
1	Shredding	Comminutor
3	Sedimentation	Circular (Primary)
3	Filtration	Low Rate - Intermittent
1	Sedimentation	Circular (Secondary)
1	Chlorine Addition	Gas - Injection
1	Chlorine Detention	
	Receiving Stream	Clear Creek

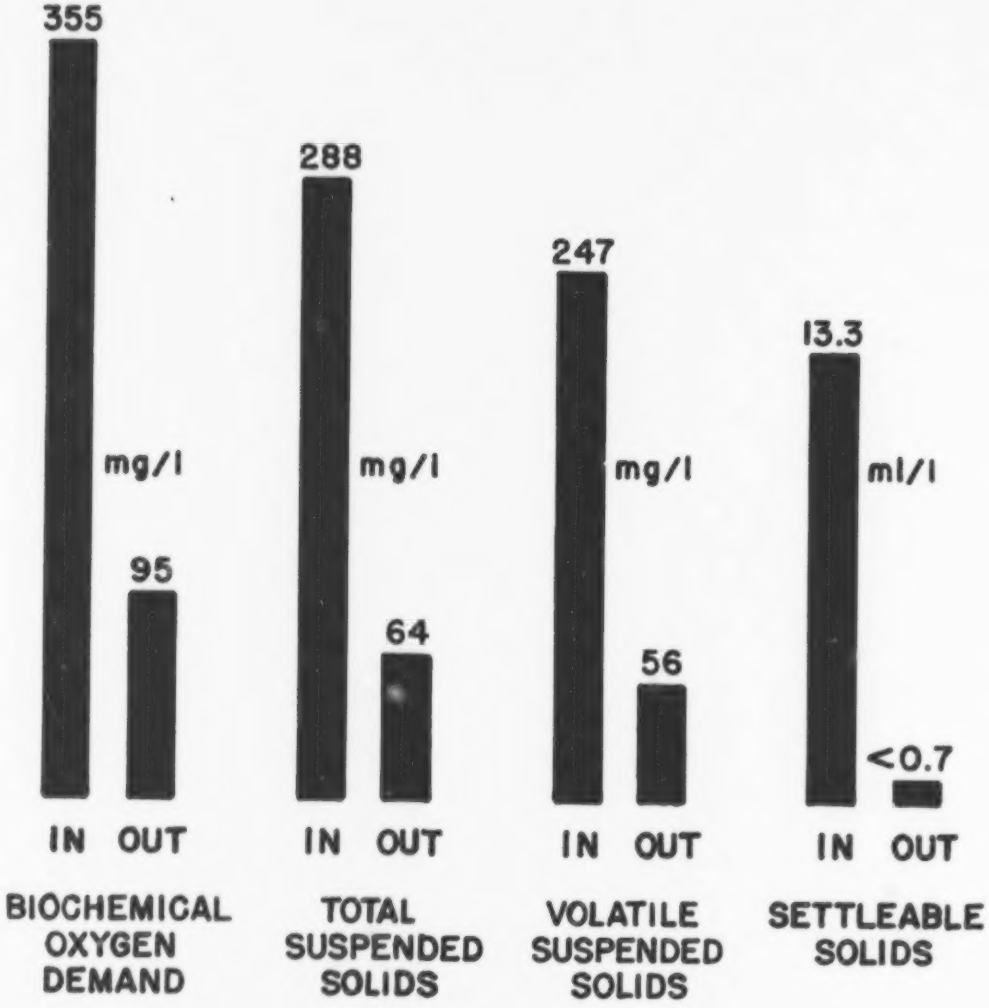
Solids Diagram


Source
Process
# Units
Process
# Units
Disposal
Primary Clarifier
Secondary Clarifier
Primary Digestion
2
Secondary Digestion
1
Sludge Beds (Drying)
Soil Conditioning
Land Fill

WHEATRIDGE SEWAGE TREATMENT PLANT

	Date	Time	Sample Type	BOD	TSS	VSS	Settleable Solids
Effluent	12/16/64	8AM-3PM	C	89	60	54	2.0
	12/17/64	8AM-3PM	C	88	72	61	< 0.1
	12/18/64	8AM-3PM	C	108	61	52	< 0.1
Average				95	64	56	<0.7
Influent	12/16/64	8AM-3PM	C	330	269	240	13.0
	12/17/64	8AM-3PM	C	415	331	285	15.0
	12/18/64	8AM-3PM	C	325	263	217	12.0
Average				355	288	247	13.3
Percent Removal				73	78	77	95

WHEATRIDGE S. T. P.
PROJECT RECORD OF PLANT PERFORMANCE
1964



FRUITDALE SANITATION DISTRICT

Type Treatment:	Primary
Population Served:	1620 persons
Average Flow:	0.2 million gallons daily (winter) 1.0 mgd (summer)
Plant capacity:	2400 persons (limited by digester)

Discussion:

The Fruitdale Sanitation District operates a primary plant discharging to Clear Creek at its intersection with Kipling Street (River mile 305.5/10.0). One operator is employed an average of 2 hours per day to maintain this installation. Facilities at this plant include a bar screen, a shredding device, primary clarification, and anaerobic sludge digesters. It should be noted that during the winter the average flow is 0.2 mgd; during the summer, however, due to high infiltration in the collection system, the average daily flow increases to a volume of 1 million gallons daily. Based upon the winter-time flows the average per capita contribution to this sewage treatment system is 125 gallons per capita per day.

An intensive sampling program conducted by the Colorado State Department of Public Health during 1963 revealed the average biochemical oxygen demand of the effluent discharged to Clear Creek during the winter months of January through May, 1963 to be 239 mg/1. During the summer months, May 1963 through October 1963, the dilution effect of high infiltration reduced the BOD of the effluent discharge to 55 mg/1. Samples collected and analyzed by Project personnel on December 29 and December 30 indicated that the average effluent had a BOD of 110 mg/1. Influent strength was 175 mg/1 BOD, indicating an average plant reduction efficiency of 37 percent. Effluent quality expressed in terms of equivalent population is 1,250 persons.

No chlorination facilities are provided at this plant.

A limited laboratory control program has been implemented on the recommendation of the District's consulting engineer. Imhoff cones are used to determine the settleable solids content of influent and effluent sewage, and operation records containing flows have been initiated in conjunction with the laboratory program.

Evaluation:

The State standard of 30 mg/1 for influent discharges to a receiving stream with a downstream water use is exceeded throughout the year. Although the plant capacity of 0.4 mgd (or 2400 persons) is not presently being exceeded, this primary plant cannot provide adequate treatment to meet the state standards. Inasmuch as this district has applied to Metropolitan Denver Sewage Disposal District No. 1 for a feasibility estimate and the feasibility estimate was in favor of Fruitdale membership, it appears that the Fruitdale Sanitation District will be committed to membership in Metro and that the effluent discharged to Clear Creek will be discontinued by January 1, 1967. In the event that the District decides not to join Metro, it appears that a complete new facility, including secondary treatment, will be necessary to provide the degree of treatment required to meet the State standards.

Although this is a very small plant, the Conference of State Sanitary Engineers recommends that a community of this size should be able to provide at least one full-time operator and one half-time laborer. In addition, the following tests should be performed: 1) settleable solids daily; 2) relative stability daily; 3) colormetric pH of raw waste water occasionally; 4) chlorine residual of effluent daily; 5) total solids of digested sludge occasionally; and 6) pH of digested sludge occasionally. Plant records should be kept in the form of a diary to reflect the results of laboratory tests, and in addition to flows, a record of routine operation parameters.

FRUITDALE STP

FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	Metering	Parshall Flume (Recording)
1	Screening	Hand Cleaned Bar Screen
1	Shredding	Comminutor
1	Sedimentation	Circular (Primary)
	Receiving Stream	Clear Creek

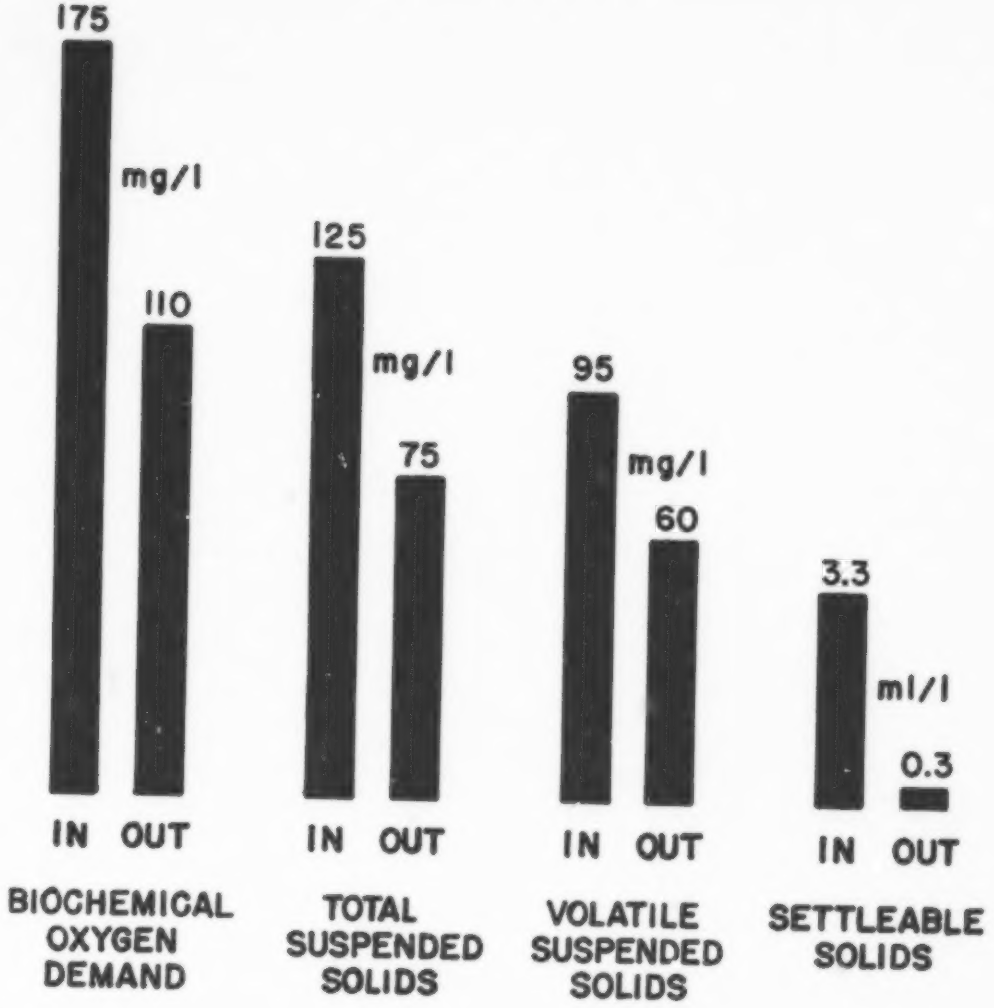
Solids Diagram

Source	Process	# Units	Process	# Units	Disposal
Primary Clarifier	Anaerobic Digestion	1	Sludge Beds (Drying)		

FRUITDALE SEWAGE TREATMENT PLANT

	Date	Time	Sample Type	BOD	TSS	VSS	Settleable Solids
Effluent	12/29/64	8AM-3PM	C	130	90	80	0.3
	12/30/64	8AM-3PM	C	94	61	41	0.2
Average				110	75	60	0.25
Influent	12/29/64	8AM-3PM	C	200	136	115	2.5
	12/30/64	8AM-3PM	C	145	113	75	4.0
Average				175	125	95	3.25
Percent Removal				37	40	37	92

FRUITDALE S.T.P.
PROJECT RECORD OF PLANT PERFORMANCE
1964



NORTHWEST LAKEWOOD SANITATION DISTRICT

Type Treatment:	Primary
Population Served:	21,000 persons
Average Flow:	1.9 million gallons daily
Plant Capacity:	1.8 million gallons daily

Discussion:

The Northwest Lakewood Sanitation District, in conjunction with the Westridge Sanitation District, operates a primary sewage treatment plant on the south bank of Clear Creek approximately one-half mile west of Kipling Street (River mile 305.5/10.2). One operator and one laborer are employed during the week to operate this plant.

Colorado State Department of Public Health sampling data indicates a gradual deterioration of the effluent quality from 80 mg/l biochemical oxygen demand in 1960 to 210 mg/l BOD in 1963. Samples collected and analyzed by the Project personnel during the period May 13 to May 15, 1964 determined the effluent quality to be 250 mg/l BOD. Influent quality for the same period of sampling was 265 mg/l BOD. Average percentage of reduction was calculated at 19 percent. Effluent quality measured in terms of an equivalent population was 17,400 persons.

Chlorination facilities have not been provided at this plant.

Laboratory facilities were not provided in the design of this plant.

Evaluation:

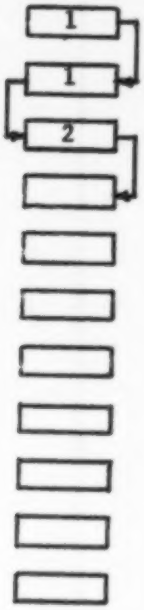
All State standards regarding effluent discharge are exceeded by this plant. Furthermore, the plant capacity has been exceeded. These two districts are committed to membership in the Metropolitan Denver Sewage Disposal District No. 1. Effluent discharge from the plant will be discontinued as of January 1, 1967.

None of the three parameters of good operation control, as set forth by the Conference of State Sanitary Engineers for a plant of this size and degree of treatment have received sufficient consideration in the operation of this plant. In addition to several laboratory tests which should be run by plant personnel, the number of operators should be increased from 1 to 2 for this plant. Furthermore, the attention given to the keeping of records should receive a greater emphasis.

NORTHWEST LAKEWOOD STP

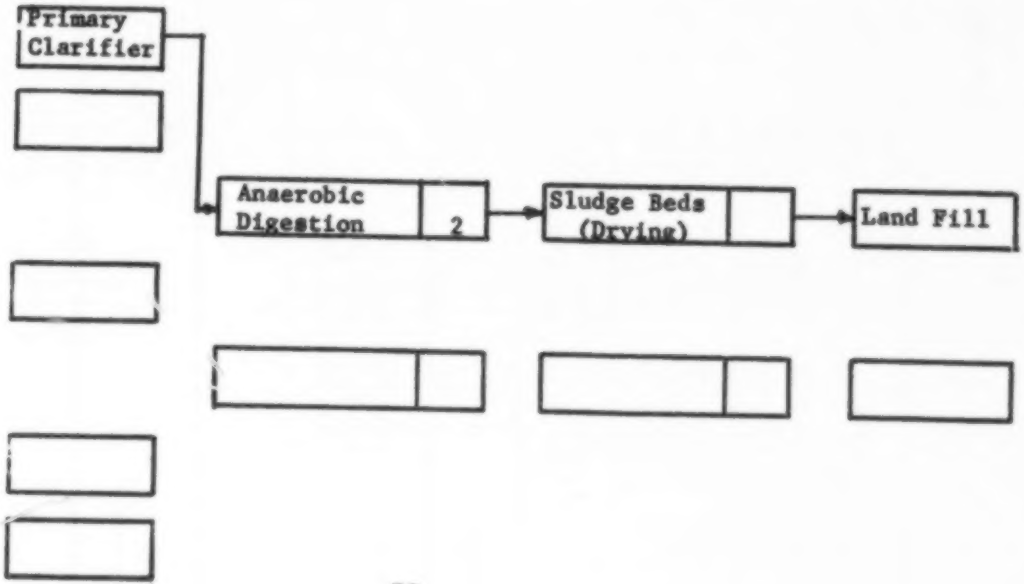
FLOW DIAGRAM

Liquid Diagram



# Units	Process	Operation Description
1	Metering	Parshall Flume (Recording)
1	Shredding	Barminutor
2	Sedimentation	Circular (Primary)
	Receiving Stream	Clear Creek

Solids Diagram



Source	Process	# Units	Process	# Units	Disposal
Primary Clarifier	Anaerobic Digestion	2	Sludge Beds (Drying)		Land Fill

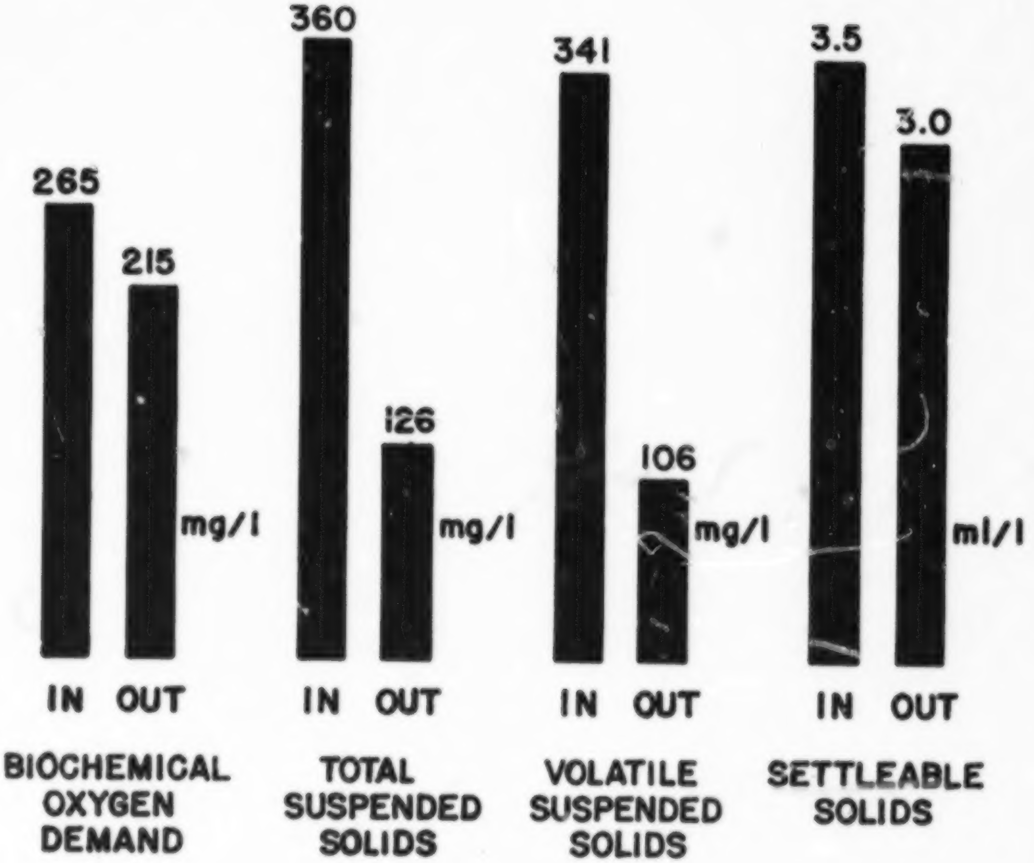
NORTHWEST LAKEWOOD SEWAGE TREATMENT PLANT

	Date	Time	Sample Type	Temp	pH	BOD	TSS	VSS	Sett Solids	Cl_2Res	Total Coli	Fecal Coli
Effluent	5/13/64	0750	Grab	14.5	6.8	--	14	0	.2	--	3.3×10^6	2.3×10^6
	5/13/64	1035	Grab	15.5	7.5	235	112	95	2.2	--	1.3×10^6	4.9×10^6
	5/14/64	0855	Grab	14.5	7.8	202	157	147	5.5	--	1.7×10^7	1.3×10^7
	5/14/64	--	Grab	--	--	--	--	--	--	--	--	--
	5/15/64	1255	Grab	17.0	7.3	230	118	102	9.3	--	2.2×10^7	4.6×10^6
	5/15/64	1455	Grab	17.5	7.4	230	162	141	1.5	--	7.9×10^6	4.6×10^6
	5/13/64	8AM-3PM	C-8	--	--	195	105	79	1.3	--	--	--
	5/14/64	8AM-3PM	C-8	--	--	185	184	168	1.0	--	--	--
	5/15/64	8AM-3PM	C-8	--	--	--	148	117	--	--	--	--
Average					7.4	215	126	106	3.0		6.6×10^6	4.7×10^6
Influent	5/13/64	8AM-3PM	C-8	--	--	295	--	--	2.7	--	--	--
	5/14/64	8AM-3PM	C-8	--	--	290	333	321	4.0	--	--	--
	5/15/64	8AM-3PM	C-8	--	--	215	387	361	3.7	--	--	--
Average						265	360	341	3.5			
Percent Removals						19	65	72	14			

NORTHWEST LAKEWOOD S.T.P.

PROJECT RECORD OF PLANT PERFORMANCE

1964



CITY OF GOLDEN
(ADOLPH COORS COMPANY)

Type Treatment:	Secondary
Population Served:	8,000 persons
Average Flow:	2.7 million gallons daily
Plant Capacity:	4.5 million gallons daily

Discussion:

The Adolph Coors sewage treatment plant located approximately one mile east of the City of Golden, discharges to Clear Creek (River mile 305.5/15.5). This plant, built and operated by the Adolph Coors Brewing Company, treats domestic wastes from the City of Golden in addition to highly organic wastes from the brewery operation. A plant superintendent, several operators, chemists, and laborers are employed by the Adolph Coors Company to attend this plant on a 24-hour basis. Average domestic per capita flow from the City of Golden is 150 gallons per day. This high flow is largely due to the combined sewer system constructed in the City of Golden.

Data provided by the Colorado State Department of Public Health for the years prior to 1964, indicates that the effluent quality from this plant, measured in terms of biochemical oxygen demand, was 350 mg/l. However, during 1963 and early 1964, a revision of treatment procedures at the sewage plant and a program of in-plant removal of solids at the brewery, was undertaken by the Adolph Coors Company. According to the treatment plant records, the average BOD value for effluent discharge was 30 mg/l in 1964. Samples collected and analyzed by the Colorado State Department of Public Health during 1964 verify this reduction in effluent BOD values. This plant is presently considered to be in conformity with State standards, except during brief periods of peak flow. Based upon 24-hour composite samples, collected by plant personnel, the average influent BOD has been 750 mg/l,representing an average plant efficiency of 96 percent. Effluent quality from this plant, expressed in terms of an equivalent population is 3,700 persons.

Bacterial density of the effluent discharged to Clear Creek is controlled by use of the chlorination facilities. An average contact time of 23 minutes is provided before the effluent is discharged to Clear Creek.

A well-equipped laboratory located at the sewage treatment plant provides the facility for plant personnel to maintain an excellent record of the plant performance. All tests recommended by the Conference of State Sanitary Engineers for a plant of this size and degree of treatment are performed on a routine basis; where applicable, 24-hour composite samples are used to determine the plant performance.

Evaluation:

Considering the State standard for effluent discharge to a watercourse with a downstream domestic water use, the plant is presently discharging a satisfactory effluent. The Coors Company should be commended for their concern with water pollution and the measures that they have taken to provide successful treatment for a highly-organic waste. The Coors Company plans an expansion of the plant facilities during the summer of 1965 to insure adequate treatment of additional wastes that can be expected in the future from an increase in brewery production. This work will provide a design capacity of 9 mgd.

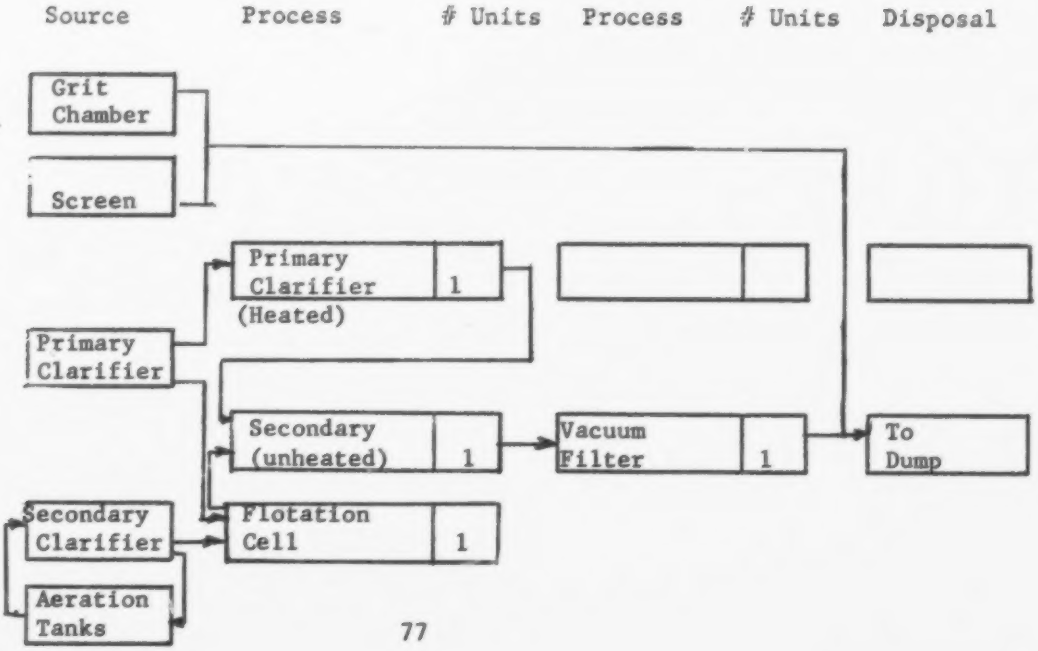
This plant is a model of successful operational control. All factors pertaining to adequate operational control as recommended by the Conference of State Sanitary Engineers have been met. In fact, for all parameters of operational control, the Coors Company has taken a step beyond that which is required.

ADOLPH COORS COMPANY
FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	Screening	Bar Screen
2	Grit Removal	Grit Chambers
2	Shredding	Comminutors
1	Sedimentation	
12	Aeration	Mechanical
1	Sedimentation	
1	Chlorine Addition	
1	Chlorine Detention	23 Minutes
	Receiving Stream	Clear Creek

Solids Diagram


Source
Process
# Units
Process
# Units
Disposal
Grit Chamber
Screen
Primary Clarifier (Heated)
1
Primary Clarifier
Secondary (unheated)
1
Vacuum Filter
1
To Dump
Secondary Clarifier
Flotation Cell
1
Aeration Tanks

CITY OF DENVER (EASTSIDE PLANT)

Type Treatment:	Primary
Population Served:	18,000 persons
Average Flow:	1.4 million gallons daily
Plant Capacity:	(included with Denver Northside Plant)

Discussion:

The Denver (Eastside) sewage treatment plant is located on the south bank of Sand Creek at a point one-half mile west of the Stapleton Airport North-South runway (River mile 306.8/4.7). The Project municipal waste engineer was unable to determine the capacity of this primary plant. However, the Metro Denver Sewage Disposal District No. 1 report published in 1961 indicates that the total capacity for both Denver Northside and Eastside plants is 85 million gallons daily. This plant is maintained by personnel assigned from the Denver Northside plant. Although this plant was considered one to which significant flows of industrial wastes were discharged, examination of the flow pattern and sewage strength revealed that it should be classified as a primarily domestic sewage treatment plant.

Colorado State Department of Public Health data show that the Biochemical Oxygen Demand of effluent discharged to Sand Creek was 281 mg/1 and 211 mg/1 for the years 1962 and 1963, respectively. Samples collected and analyzed by Project personnel during the period April 15 through April 17, 1964 indicated an average effluent quality of 205 mg/1 BOD. Influent strength for the period of Project sampling was 340 mg/1 for an average plant efficiency of 40 percent. Effluent quality expressed in a population equivalent was 12,800 persons.

Chlorination facilities have been provided at the Denver Eastside plant and are used to chlorinate the effluent; however for 5 out of the 6 grab samples taken from the Denver Eastside effluent, the chlorine residual was less than .1 mg/1. Bacterial density as determined by the Project bacteriologist, showed that the effluent from this plant is above the allowable State standard.

Laboratory support for analysis of the sewage quality at the Denver Eastside plant is furnished by the Denver Northside plant personnel. Three samples per week are collected by personnel at the Denver Eastside plant and transported to the laboratory facilities at the Northside plant for determination of suspended solids, both total and volatile, and 5-day BOD. Records of the laboratory analysis and estimated flows are maintained at the Denver Northside plant.

Evaluation:

Comparison to the State standards for effluent discharge reveals that the Denver Eastside plant is in violation of current effluent standards. Considering the appearance of the plant and the type of maintenance procedures which are in effect, it is rather fortunate that an average percentage efficiency of 40 percent is obtained by the Denver Eastside plant. Inasmuch as this plant and the City of Denver are committed to membership in the Denver Metropolitan Sewage Disposal District No. 1, effluent discharge from the plant will be discontinued by January 1, 1967.

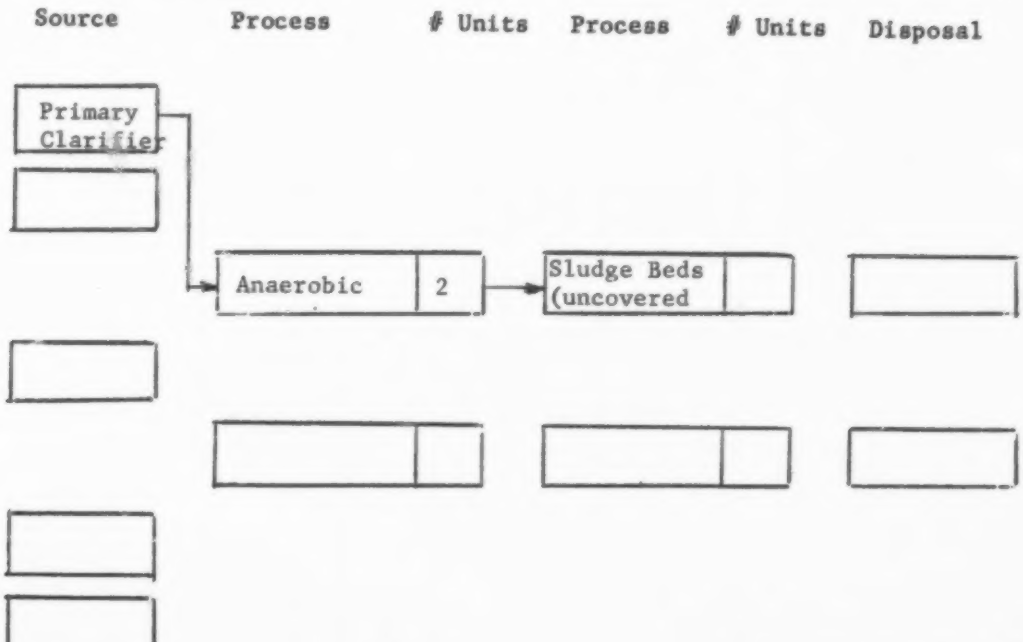
Although some laboratory analyses are performed to determine plant operating conditions, a more frequent sampling program, coupled with an increased emphasis on maintaining plant facilities, would provide the City of Denver with a more complete knowledge of the plant performance.

DENVER(EASTSIDE)
FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	Screening	
1	Sedimentation	Circular
1	Chlorination	
1	Receiving Stream	Sand Creek

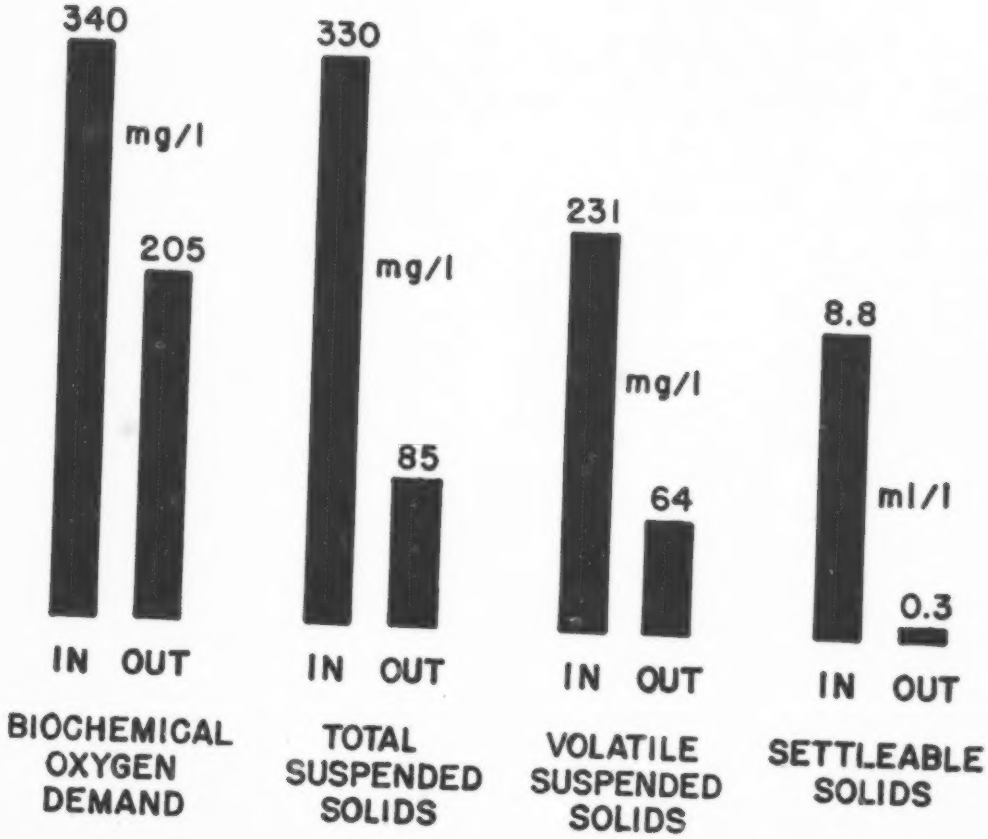
Solids Diagram


Source
Process
# Units
Process
# Units
Disposal
Primary Clarifier
Anaerobic
2
Sludge Beds (uncovered

DENVER (EASTSIDE) SEWAGE TREATMENT PLANT

	Date	Time	Sample Type	Temp	pH	BOD	TSS	VSS	Sett Solids	Cl$_2$Res	Total Coli	Fecal Coli
Effluent	4/15/64	1105	Grab	15.0	6.8	200	80	63	$<$ 0.1	$<$ 0.1	34.8x10^{5}	7.9x10^{5}
	4/15/64	1400	Grab	17.5	6.5	205	102	78	0.1	$<$ 0.1	34.8x10^{4}	7.0x10^{4}
	4/16/64	1230	Grab	18.0	6.9	175	42	26	$<$ 0.1	$<$ 0.1	4.9x10^{3}	4.9x10^{3}
	4/16/64	1615	Grab	18.0	7.0	100	91	79	$<$ 0.1	0.35	3.3x10^{2}	2.4x10^{2}
	4/17/64	0830	Grab	12.0	7.9	175	84	70	0.1	$<$ 0.1	34.5x10^{5}	27.8x10^{5}
	4/17/64	1500	Grab	17.0	7.8	275	--	--	1.5	$<$ 0.1	1.3x10^{6}	4.9x10^{5}
	4/15/64	8AM-3PM	C-8	--	--	210	76	57	0.3	--	--	--
	4/16/64	8AM-3PM	C-8	--	--	225	104	70	0.3	--	--	--
	4/17/64	8AM-3PM	C-8	--	--	265	98	69	0.3	--	--	--
Average					7.2	205	85	64	$<$ 0.3	$<$ 0.14	1.4x10^{5}	6.7x10^{4}
Influent	4/15/64	8AM-3PM	C-8	--	--	350	426	285	8.5	--	--	--
	4/16/64	8AM-3PM	C-8	--	--	370	376	252	9.0	--	--	--
	4/17/64	8AM-3PM	C-8	--	--	300	189	157	9.0	--	--	--
Average						340	330	231	8.8			
Percent Removals						40	74	68	97			

CITY OF DENVER — EASTSIDE S.T.P.
PROJECT RECORD OF PLANT PERFORMANCE
1964



CITY OF AURORA (WESTERLY CREEK PLANT)

Type Treatment:	Secondary
Population Served:	55,000 persons
Average Flow:	3.1 million gallons daily
Plant Capacity:	2.5 million gallons daily

Discussion:

The City of Aurora Westerly Creek Plant is located on East 23rd Avenue at its intersection with Chester Street, just south of the Stapleton International Airport. Effluent from the plant is discharged into Westerly Creek, which enters an outfall line beneath Stapleton Airport, and discharges into Sand Creek (River mile 306.9/5.5). This is a standard, high-rate trickling filter plant with additional facilities for pre-aeration of the sewage. Five operating personnel, including a superintendent and a chemist, are employed by the City of Aurora to maintain this plant for a 24-hour per day period. Additional sewage flows from the City of Aurora are transported to the new Aurora Sand Creek plant which will be described in a subsequent report.

Colorado State Department of Public Health sampling data indicates that the biochemical oxygen demand of the effluent discharge to Sand Creek has been 66 mg/1 and 80 mg/1 for the years 1962 and 1963, respectively. A sampling program undertaken by the Colorado State Department of Public Health during the year 1964 showed that the effluent BOD was 74 mg/1. Samples collected and analyzed by the Project personnel during the period April 15 through April 17, 1964 indicated that the average effluent discharged to Sand Creek had a BOD of 64 mg/1. During the same period of Project sampling, the influent BOD was 315 mg/1, reflecting an average plant efficiency of 80 percent. The effluent discharge to Sand Creek had a population equivalent of 8,530 persons.

Chlorination facilities have been provided at this plant and are used to chlorinate the effluent. During the period of Project sampling, 5 out of the 6 grab samples collected indicated a chlorine residual of less than .1 parts per million. Bacterial density of the effluent discharge was shown to be 4.2×10^6 coliform organisms per 100 ml. Chlorine detention time is provided by the one-mile outfall to Sand Creek.

A very complete laboratory has been provided at the plant, and is used by the plant chemist to determine sewage quality and the plant performance. The plant chemist is also responsible for the keeping of operation records for this plant.

Evaluation:

This plant is currently in violation of the State standards for sewage effluent discharge. It is clear that the plant capacity has been exceeded. The City of Aurora has current plans to expand the Sand Creek plant and divert flows in excess of the Westerly Creek plant capacity to the new plant for treatment. In terms of both present conditions and future loadings which might be expected, it appears reasonable that this course of action should be taken by the City of Aurora.

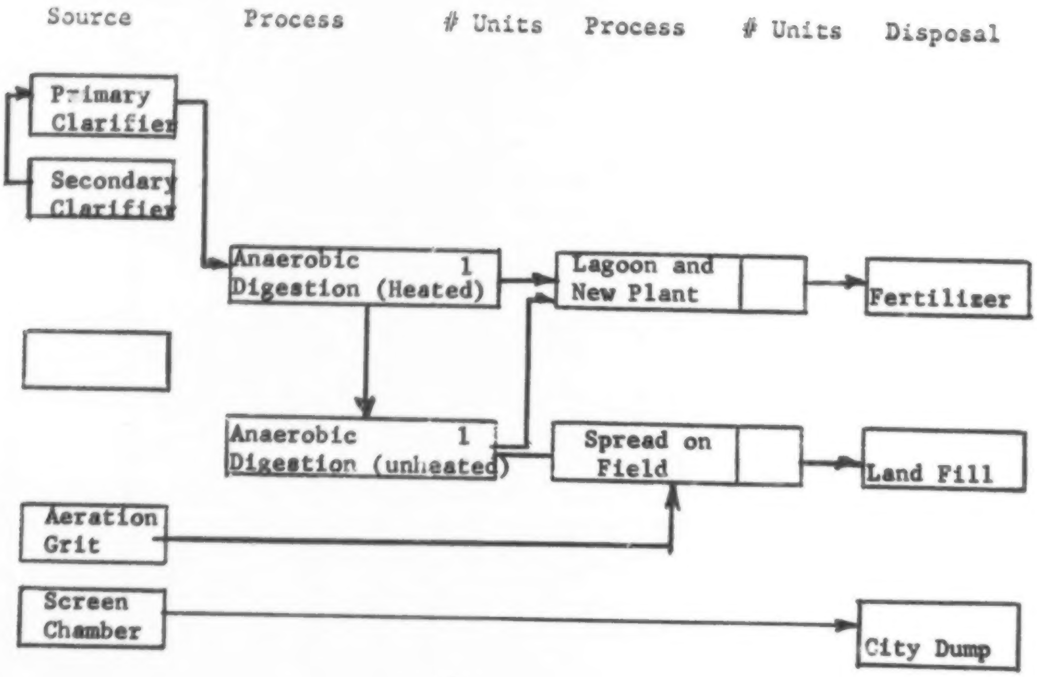
Operation of this plant is currently in conformance with the "Recommendations for Minimum Personnel, Laboratory Control and Records," as adopted by the State Conference of State Sanitary Engineers.

AURORA (WESTERLY CREEK)
FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	Metering	Parshall Flume
1	Screening	Automatically cleaned
1	Aeration	3 Mechanical aerators with automatic grit removal
1	Sedimentation	Circular
1	Filtration	High-rate trickling Filter
1	Sédimentation	Circular
1	Chlorine addition	
1	Chlorine detention	Effluent line
	Receiving stream	Sand Creek

Solids Diagram

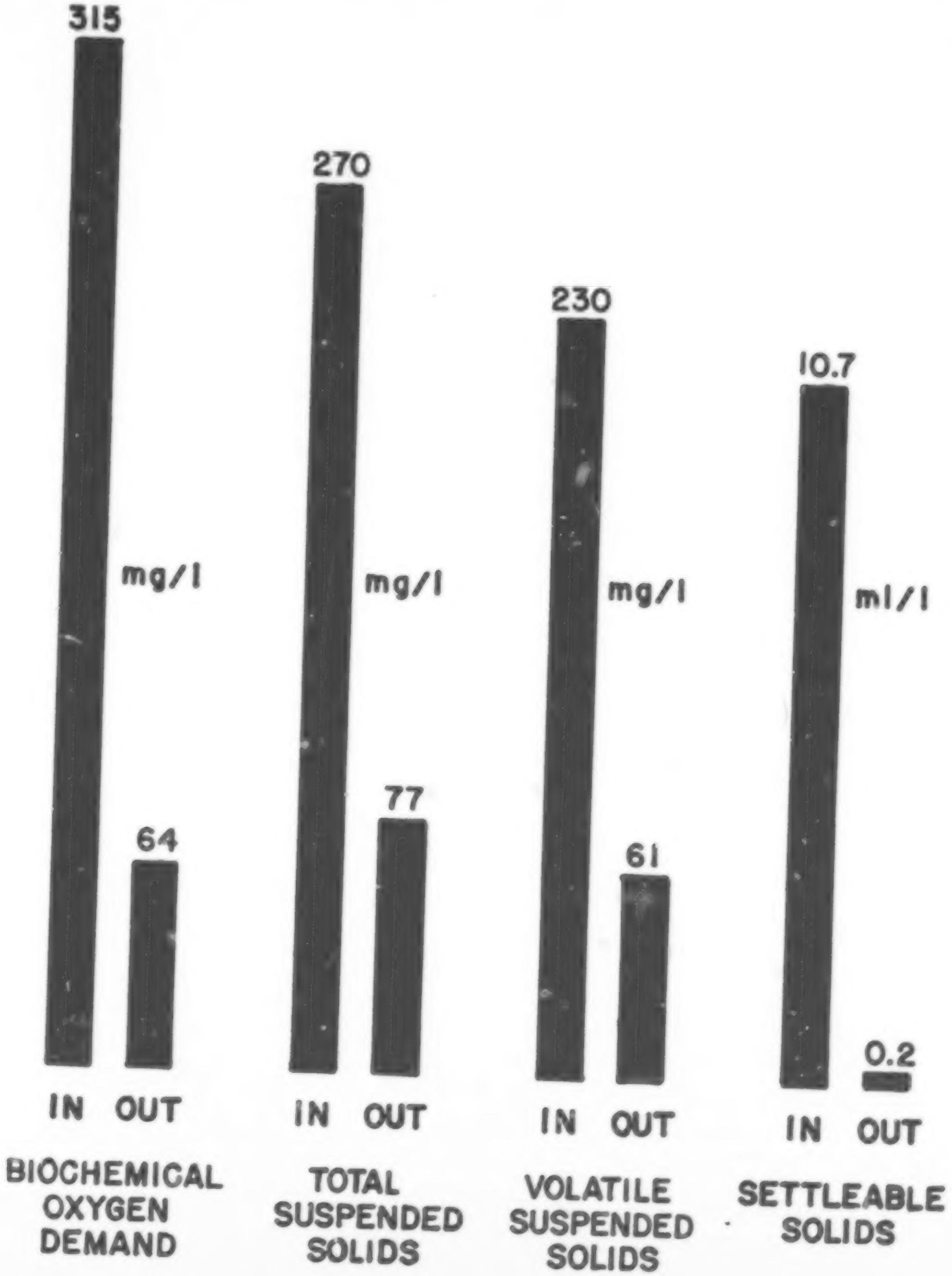

Source
Process
# Units
Process
# Units
Disposal
Primary Clarifier
Secondary Clarifier
Anaerobic Digestion (Heated) 1
Anaerobic Digestion (unheated) 1
Lagoon and New Plant
Fertilizer
Spread on Field
Land Fill
Aeration Grit
Screen Chamber
City Dump

AURORA SEWAGE TREATMENT PLANT

(WESTERLY CREEK)

	Date	Time	Sample Type	Temp	pH	BOD	TSS	VSS	Sett Solids	Cl_2Res	Total Coli	Fecal Coli
Effluent	4/15/64	1025	Grab	16.0	7.3	61	78	61	0.3	< 0.1	10.9×10^6	27.8×10^5
	4/15/64	1315	Grab	17.0	6.9	67	91	71	0.3	< 0.1	10.9×10^6	17.5×10^5
	4/16/64	1200	Grab	17.0	7.6	53	68	48	0.2	0.1	17.2×10^5	27.8×10^4
	4/16/64	1650	Grab	17.5	7.5	50	84	60	0.1	0.35	2.4×10^6	7.9×10^5
	4/17/64	0800	Grab	13.0	7.3	57	60	42	0.1	< 0.1	2.4×10^6	1.3×10^6
	4/17/64	1430	Grab	15.0	7.5	58	--	--	0.3	< 0.1	4.9×10^6	2.2×10^6
	4/15/64	8AM-4PM	C-9	--	--	72	91	82	0.1	--	--	--
	4/16/64	8AM-4PM	C-9	--	--	--	66	56	0.2	--	--	--
	4/17/64	8AM-4PM	C-9	--	--	95	78	67	0.2	--	--	--
Average					7.4	64	77	61	0.2	< 0.14	4.2×10^6	1.2×10^6
Influent	4/15/64	8AM-4PM	C-9	--	--	245	265	204	8.0	--	--	--
	4/16/64	8AM-4PM	C-9	--	--	330	272	256	12.0	--	--	--
	4/17/64	8AM-4PM	C-9	--	--	375	275	229	12.0			
Average						315	270	230	10.7			
Percent Removals						80	71	73	98			

CITY OF AURORA — MAIN S. T. P.
PROJECT RECORD OF PLANT PERFORMANCE
1964



CITY OF AURORA (SAND CREEK PLANT)

Type Treatment: Secondary

Population Served: 9,000 persons

Average Flow: 0.66 million gallons daily

Plant Capacity: 1.0 million gallons daily

Discussion:

The City of Aurora Sand Creek Plant is located on the north bank of Sand Creek approximately one-half mile west of Peoria Street (River mile 306.8/6.8). This plant, which is based upon the extended aeration process, is operated with personnel assigned from the Westerly Creek plant. Included in the facilities of this plant are a number of automated operations, including a screen-washing unit, an automatic grit removal device and an incinerator for the washed screenings. This plant was completed and placed in operation in December of 1963.

Effluent samples collected by the Colorado State Department of Public Health showed an average quality of 20 mg/1 BOD during the year 1964. Samples collected and analyzed by Project personnel during the period April 15 through April 17,1964 showed an average effluent discharge of 22 mg/1 BOD. Influent quality measured at the same time by Project personnel assigned an average value of 255 mg/1 BOD, resulting in an average plant efficiency of 92 percent. Effluent quality expressed in terms of equivalent population was determined to be 625 persons.

Chlorination facilities at the plant are used to chlorinate the effluent and during the period of Project sampling maintained an average residual in the effluent of .37 mg/1. Measured bacterial density of the effluent during this period was less than 18 organisms per ml.

Laboratory support providing analysis of samples collected by the Sand Creek plant personnel is provided by the chemists at the Westerly Creek plant. Furthermore, the chemist at the Westerly Creek plant is charged with the keeping of all records pertaining to these laboratory analyses of the Sand Creek sewage. Records of flow and other pertinent factors of operational control are maintained at the Sand Creek plant by the personnel assigned to its operation.

Evaluation:

Samples collected and analyzed by all agencies concerned have established that the Sand Creek plant is currently in conformance with State standards for effluent discharges. Furthermore, it appears that ample plant capacity is present, providing that additional flows do not exceed the plant capacity. Should Aurora decide to divert sewage flows in excess of the Westerly Creek plant capacity to the Sand Creek plant, it appears advisable to provide additional facilities at the Sand Creek plant.

Plant records at the Sand Creek plant reveal that flow measurement since the plant was placed in operation is quite erratic. The records are maintained, but the flow measurements themselves appear to be erroneous. Records of the operation should be used to a greater extent to determine any corrections to plant operating conditions which may be required. More intensive efforts should be made to correlate records with the plant operation, and measures taken to correct any deficiencies which are revealed in the plant operating records.

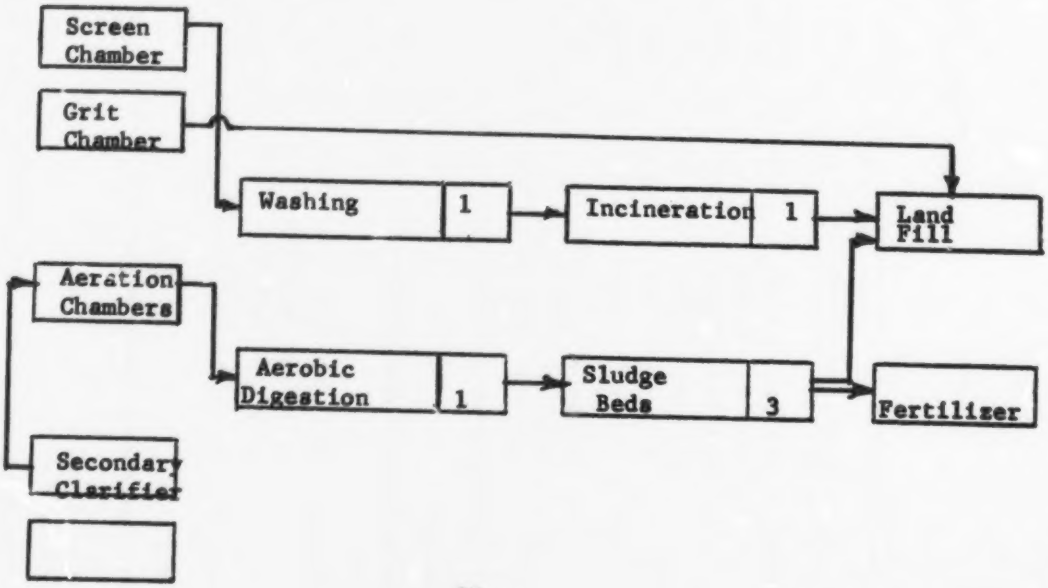
AURORA (SAND CREEK)
FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	Metering	Parshall Flume
1	Screening	Enclosed (Heated)
1	Grit Removal	" (Heated)
1	Aeration	Mechanical Hi-cone aerator
1	Sedimentation	Circular
1	Chlorine addition	70#/day
1	Chlorine detention	15 minutes
	Receiving Stream	Sand Creek

Solids Diagram

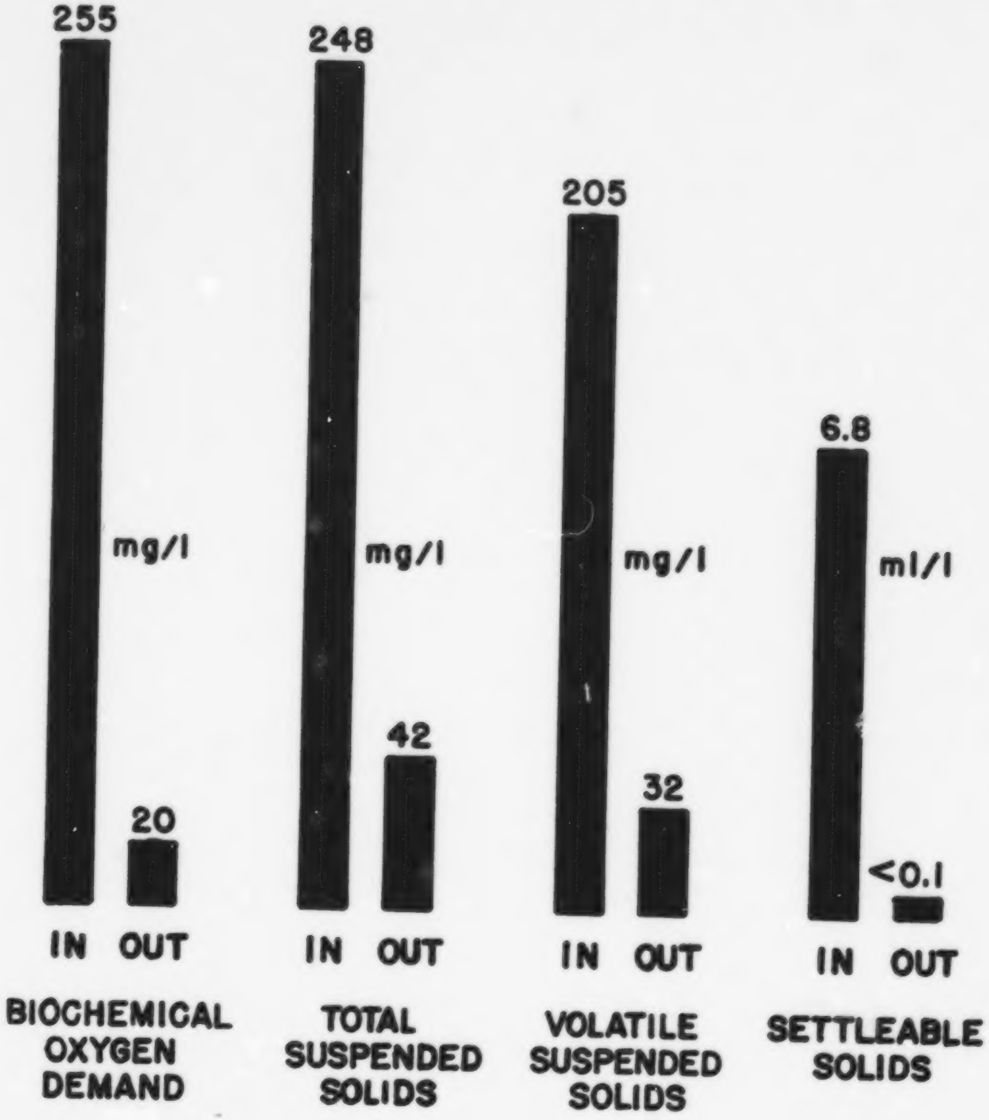
Source Process # Units Process # Units Disposal


Screen Chamber
Grit Chamber
Washing
1
Incineration
1
Land Fill
Aeration Chambers
Aerobic Digestion
1
Sludge Beds
3
Fertilizer
Secondary Clarifier

AURORA (SAND CREEK) SEWAGE TREATMENT PLANT

	Date	Time	Sample Type	Temp	pH	BOD	TSS	VSS	Sett Solids	Cl_2Res	Total Coli	Fecal Coli
Effluent	4/15/64	1045	Grab	13.5	7.2	17	34	29	<0.1	0.15	1.3×10^2	1.7×10^1
	4/15/64	1330	Grab	14.0	7.0	38	103	70	<0.1	0.1	54.2×10^1	3.3×10^1
	4/16/64	1215	Grab	14.5	7.5	--	33	17	0.3	0.2	1.7×10^1	$<1.8\times10^0$
	4/16/64	1630	Grab	14.5	7.6	--	25	20	<0.1	0.5	7.8×10^0	$<1.8\times10^0$
	4/17/64	0815	Grab	12.0	7.3	15	41	32	<0.1	0.5	$<1.8\times10^0$	$<1.8\times10^0$
	4/17/64	1445	Grab	13.0	7.5	--	--	--	<0.1	0.75	2.0×10^0	$<1.8\times10^0$
	4/15/64	8AM-4PM	C-9	--	--	17	37	35	<0.1	--	--	--
	4/16/64	8AM-4PM	C-9	--	--	15	33	28	<0.1	--	--	--
	4/17/64	8AM-4PM	C-9	--	--	--	27	27	<0.1	--	--	--
Average					7.4	20	42	32	<0.1	0.37	$<1.8\times10^1$	$<4.2\times10^0$
Influent	4/15/64	8AM-4PM	C-9	--	--	210	208	179	4.5			
	4/16/64	8AM-4PM	C-9	--	--	290	312	244	9.0			
	4/17/64	8AM-4PM	C-9	--	--	265	223	191	7.0			
Average						255	248	205	6.8			
Percent Removals						92	84	84	99			

CITY OF AURORA — ALTURA S.T.P.
PROJECT RECORD OF PLANT PERFORMANCE
1964



FITZSIMONS ARMY HOSPITAL

Type Treatment:	Secondary
Population Served:	2,900 persons
Average Flow:	.47 million gallons daily
Plant Capacity:	.9 million gallons daily

Discussion:

The Department of Army operates a treatment plant at Fitzsimons Army Hospital. This plant discharges to Sand Creek via a polishing pond located on the south bank of the Creek (River mile 306.8/6.9). One superintendent and two operators are employed by the Army to operate this high-rate trickling filter plant. In addition to wastes discharged from the hospital, which contain a high density of bacterial population, the wastes from a laundry operated on the base are received by this plant.

Composite samples are collected by the plant personnel on a routine basis to determine the various parameters of the influent and effluent sewage quality. Samples collected by the plant personnel during the past two years of operation have shown the average effluent BOD to be less than 30 mg/1. Suspended solids content of the effluent has been less than 40 mg/1. Samples collected by Project personnel during the past several months indicate that the bacterial density of discharge to Sand Creek has been below the current State standard of 100,000 organisms per 100 ml. Influent strength during the past two years of operation reveals that the incoming sewage has a strength of 300 mg/1 BOD, resulting in a plant efficiency of 91 percent. Effluent discharge to Sand Creek expressed in terms of an equivalent population is 440 persons.

Chlorination facilities have been provided in the plant design and are used to chlorinate the effluent. Average chlorine residual in the effluent for the past two years of operation has been .33 and .24 mg/1 for the years 1963 and 1964, respectively. Chlorine detention is provided in the polishing pond to which effluent is discharged and from which flow is discharged to Sand Creek.

As indicated above, a laboratory is located at the plant and is used by the plant superintendent to determine all factors of sewage quality. In addition, a complete record of plant operation is maintained to reflect hourly flows, laboratory tests and all other pertinent factors of plant operation.

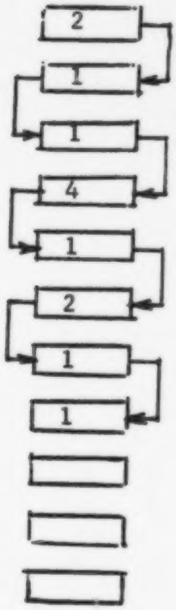
Evaluation:

This plant is in conformance with current state standards for municipal waste discharge. A relatively stable population at this installation would indicate that present plant capacity is adequate for the forseeable future.

Operational control exercised at this plant is excellent and in conformance with the "Minimum Recommendations for Personnel, Laboratory Control and Records," adopted by the Conference of State Sanitary Engineers.

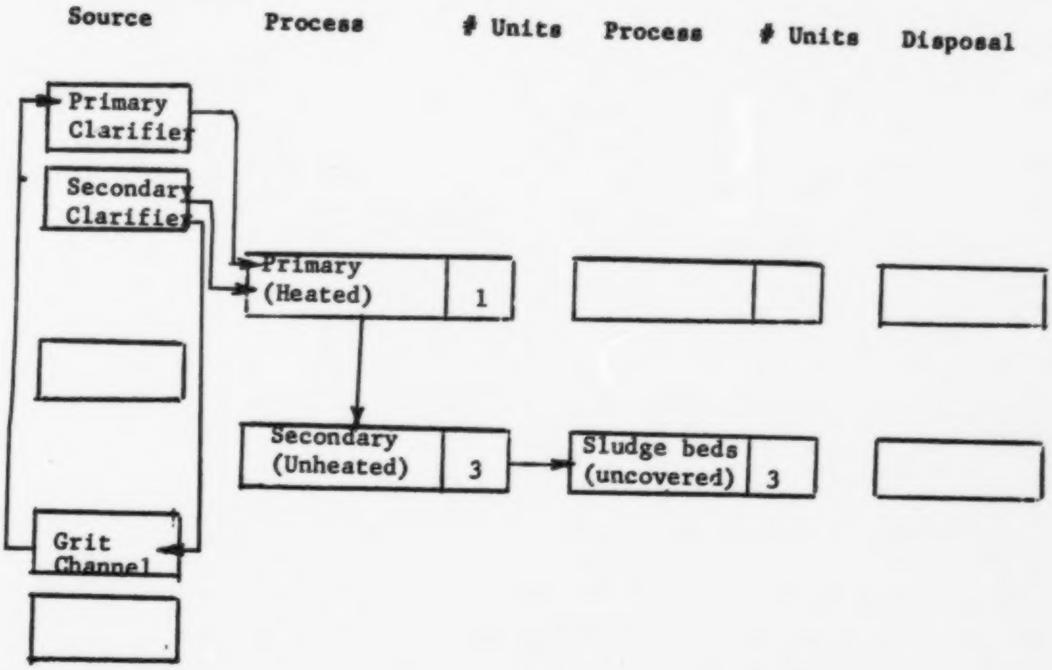
FITZSIMONS ARMY HOSPITAL
FLOW DIAGRAM

Liquid Diagram



# Units	Process	Operation Description
2	Grit Removal	Capacity 0.80 mgd
1	Shredding	
1	Sedimentation	0.85 mgd capacity
4	Filtration	0.96 mgd capacity
1	Sedimentation	0.90 mgd plus capacity
2	Chlorine Addition	200#/day capacity
1	Chlorine Detention	0.34 mgd 3/15 min. det.
1	Effluent Reservoir	
	Receiving Stream	Toll Gate Creek

Solids Diagram


Source
Process
# Units
Process
# Units
Disposal
Primary Clarifier
Secondary Clarifier
Grit Channel
Primary (Heated)
1
Secondary (Unheated)
3
Sludge beds (uncovered)
3

BUCKLEY AIR STATION

Type Treatment:	Secondary
Population Served:	400 persons
Average Flow:	.05 million gallons daily
Plant Capacity:	1.5 million gallons daily

Discussion:

The Buckley Air Station sewage treatment plant is located at the western boundary of the base adjacent to Sixth Avenue, and discharges effluent to Sand Creek (River mile 306.8/11.9). This standard trickling filter plant was designed during the second World War for a substantially greater population than is presently served. Consequently the plant processes flows far below that which it is designed to handle. With the low flows being processed it is necessary to intermittently dose the trickling filters, which has resulted in poor filter growth. Responsibility for the operation of this plant rests with one man, who spends approximately two hours per day at the plant site. Neglect of proper maintenance at the plant has resulted in gradual deterioration of the plant units. However, because of the low flows, the plant is able to maintain a satisfactory to good degree of treatment.

A sample collected and analyzed by Project personnel indicated that the incoming sewage strength is 135 mg/l biochemical oxygen demand. The effluent quality was determined to be 23 mg/l for a plant percentage reduction of 83 percent. Population equivalent of the effluent was calculated to be 55 persons.

There are no chlorination facilities provided at this plant.

A limited laboratory, which is located at the plant site, is not used at the present time. Past records indicate that when the plant was operating closer to design capacity, a complete record of laboratory control features was maintained.

Evaluation:

Because of the very low flows which are received by this plant, the plant is able to maintain an effluent in conformance with current State standards for effluent discharges, with the exception of coliform. There appears to be ample capacity to assure satisfactory treatment of all future predicted flows to this plant. Should the tributary population to this plant increase, a more conscientious effort will be required to provide a satisfactory degree of treatment.

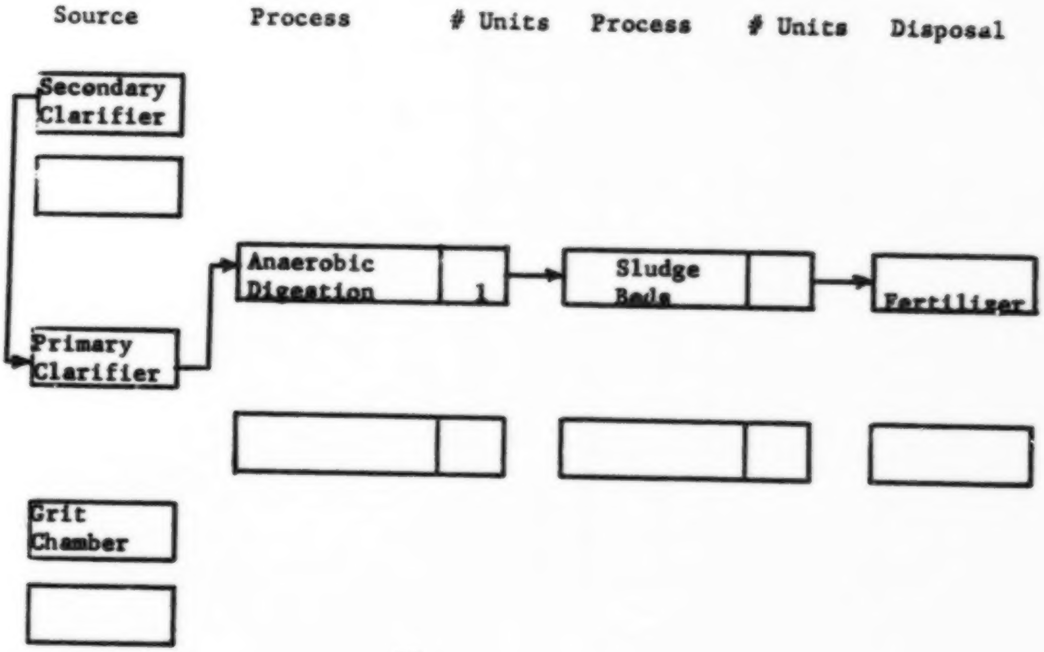
Very little operation control is presently exercised by the operating personnel. Operation of this plant is not currently in conformance with the "Recommended Minimum Recommendations for Personnel, Laboratory Control and Records." If the plant should be required to provide treatment to a substantially increased number of people, it should be noted that considerably more effort will be required to the keeping of proper records and the performance of laboratory tests than is presently practiced.

BUCKLEY AIR STATION
FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	Parshall Flume	Continuous - Recording
1	Screening	
1	Grit Removal	
1	Shredding	Comminutor
1	Sedimentation	Circular
2	Filtration	Intermittent Circular
1	Sedimentation	Circular
	Receiving Stream	Sand Creek

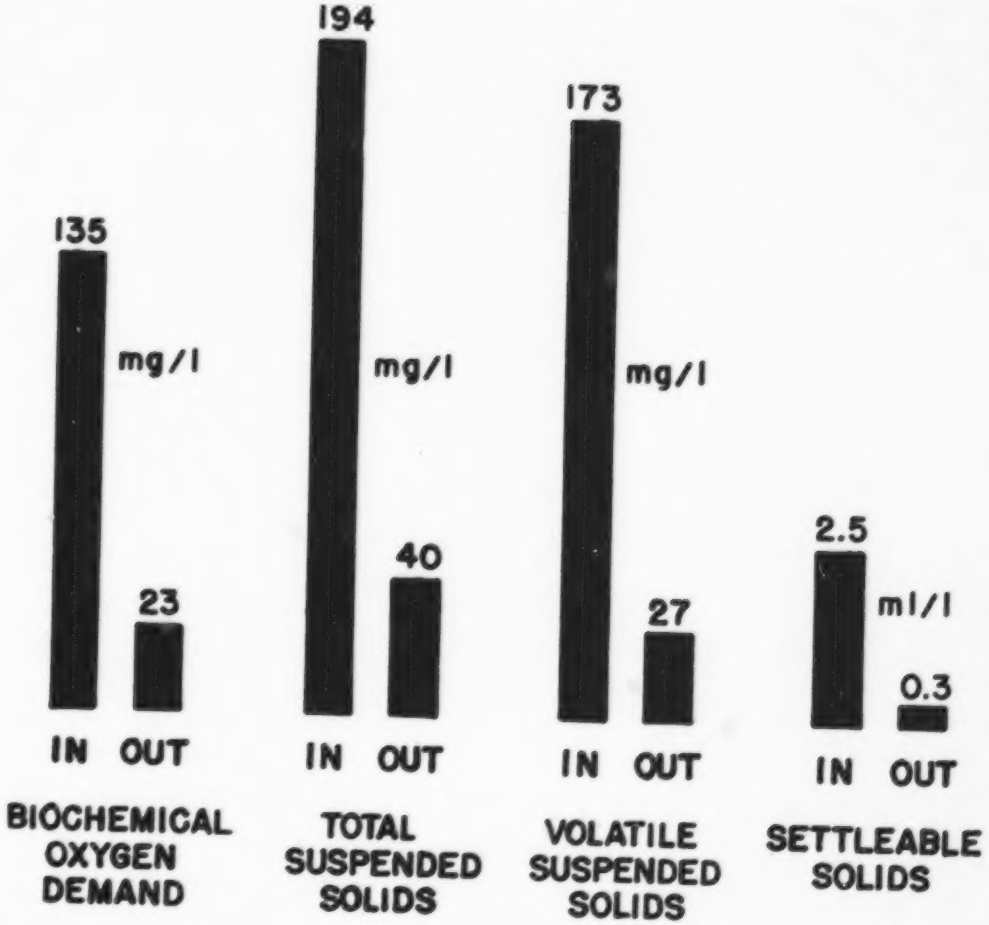
Solids Diagram


Source
Process
# Units
Process
# Units
Disposal
Secondary Clarifier
Primary Clarifier
Grit Chamber
Anaerobic Digestion
1
Sludge Beds
Fertilizer

BUCKLEY AIR STATION SEWAGE TREATMENT PLANT

	Date	Time	Sample Type	BOD	TSS	VSS	Sett. Solids	Total Coli	Fecal Coli
Effluent	6/9/64	1100	Grab	23	40	27	0.3	7.9×10^4	3.6×10^4
Influent	6/9/64	1105	Grab	135	194	173	2.5	--	

BUCKLEY AIR STATION S.T.P.
PROJECT RECORD OF PLANT PERFORMANCE
1964



CITY OF GLENDALE

Type Treatment:	Primary
Population Served:	300 persons
Average Flow:	.3 million gallons daily
Plant Capacity:	.9 million gallons daily

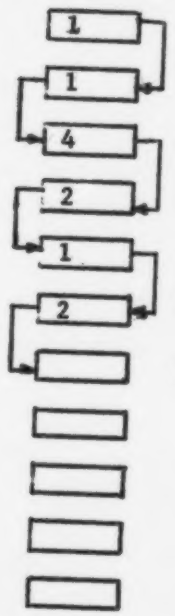
Discussion:

The City of Glendale operates an extended aeration sewage treatment plant on the north bank of Cherry Creek, approximately one-quarter mile east of its intersection with Colorado Boulevard (River mile 312.3/5.7). This plant operates under an injunction by the City of Denver against Glendale requireing that no effluent be discharged to Cherry Creek. Consequently, two abandoned gravel pits located adjacent to the plant are used as evaporative lagoons with no surface effluent discharge.

Since no effluent is discharged to Basin streams, a further evaluation was not undertaken by Project personnel.

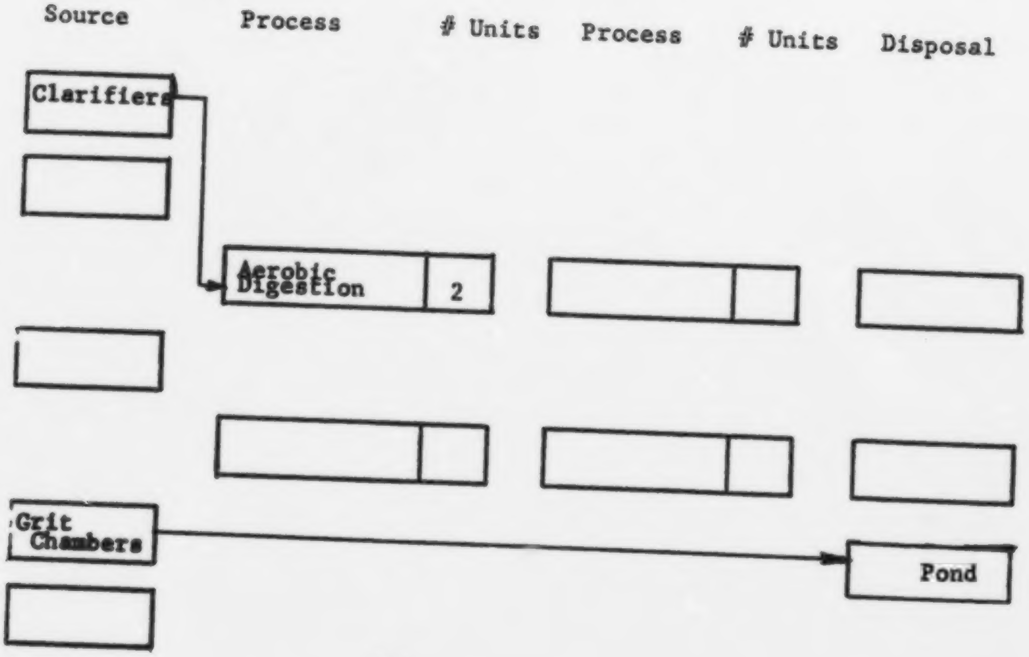
CITY OF GLENDALE
FLOW DIAGRAM

Liquid Diagram



# Units	Process	Operation Description
1	Grit Removal	Hand-cleaned chamber
1	Shredding	Comminutor
4	Aeration	Hi-cone mechanical Aerators
2	Sedimentation	Rectangular
1	Chlorine addition	
2	Chlorine Detention	Baffled Basin
	Receiving stream	None (Abandoned gravel pits - no overflow)

Solids Diagram


Source
Process
# Units
Process
# Units
Disposal
Clarifiers
Aerobic Digestion
2
Grit Chambers
Pond

COLORADO INDUSTRIAL SCHOOL FOR GIRLS

Type Treatment:	Intermediate
Population Served:	225 persons
Average Flow:	0.02 million gallons daily
Plant Capacity:	0.03 million gallons daily

Discussion:

The State of Colorado operates a lagoon-type facility located at the site of the Colorado Industrial School for Girls, just south of Hampden Avenue and approximately one and one-half miles west of Wadsworth Boulevard. Although located in the Bear Creek drainage basin, there is presently no effluent discharged to the Creek from these lagoon facilities. Operation of these facilities is the responsibility of the maintenance supervisor for the Girls' School. Pre-treatment is provided by septic tanks located approximately 100 yards south of the lagoon.

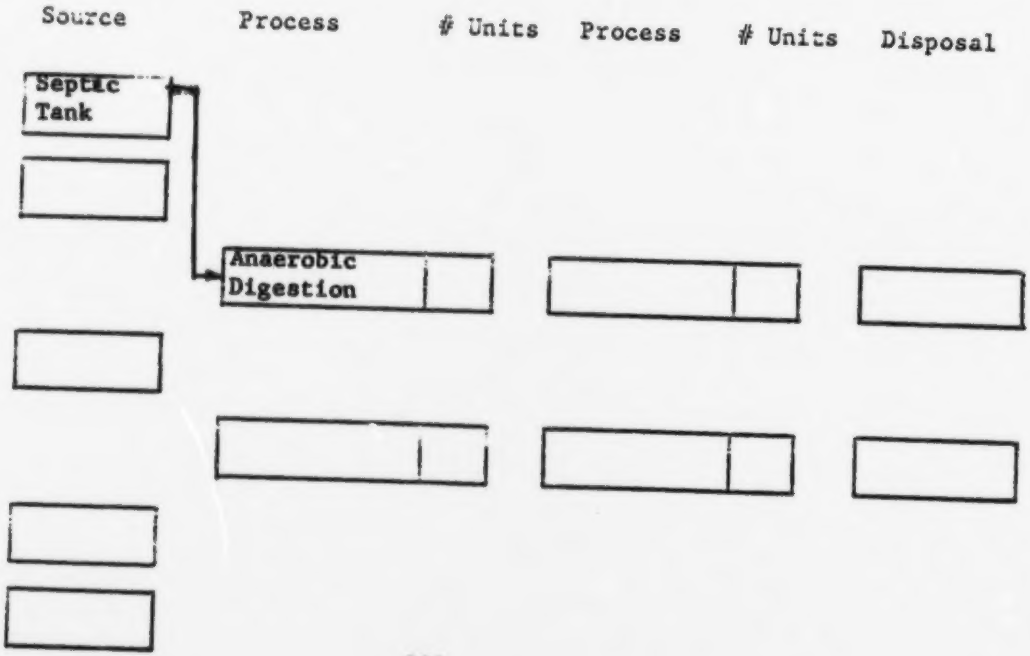
Samples collected by the Colorado State Department of Public Health from the surface of the lagoons indicates a relatively high biochemical oxygen demand. However, since there is no surface discharge to basin streams, this facility received no further consideration by the Project personnel.

COLORADO INDUSTRIAL SCHOOL FOR GIRLS
FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	Sedimentation	Septic Tank
2	Sedimentation	Lagoon (300'x120') evaporative
	Receiving Stream	No effluent

Solids Diagram


Source
Process
# Units
Process
# Units
Disposal
Septic Tank
Anaerobic Digestion

FEDERAL CORRECTIONAL INSTITUTION

Type Treatment:	Intermediate
Population Served:	425 Persons
Average Flow:	0.06 million gallons daily
Plant Capacity:	0.6 million gallons daily

Discussion:

The Department of Justice, through the Bureau of Prisons, operates a sewage treatment plant located at the Federal Correctional Institution. This plant, based upon an Imhoff tank design and followed by an intermittent trickling filter, discharges to Bear Creek at its intersection with Kipling Street (River mile 320.9/5.5). The plant is maintained by prison labor, with supervision provided by the Superintendent of Maintenance for the Institution. Two nearby schools have previously obtained permission to connect raw sewage discharges to the Federal Correctional Institution's outfall line to Bear Creek.

Samples collected by the Colorado State Department of Public Health from the Federal Correctional Institution's outfall line both above and below the influent of raw sewage originating from the two schools, have indicated that the Federal Correctional Institution is in violation of State standards. Samples collected and analyzed by Project personnel from the outfall line above the influents of the two schools indicated an average effluent strength of 165 mg/l biochemical oxygen demand. During the same sampling period, the influent quality was measured at 570 mg/l, providing an average percentage efficiency of 71 percent. Population equivalent of the effluent was 315 persons.

No chlorination facilities were provided in the design of this plant.

There are no laboratory facilities at this plant.

Evaluation:

This plant is currently in violation of State Standards for effluent discharged to Basin streams and should take steps to insure adequate treatment. Although the present flows do not exceed the plant capacity, the facilities are not adequate to handle the loads imposed upon them. The Bureau of Prisons is currently undertaking a study of proposals from two sanitation districts which have offered to treat the Institution's wastes. Should the Institution decide not to enter into agreement with one of the sanitation districts, it will be necessary to renovate and expand the plant facilities to provide the degree of treatment required to meet State effluent standards.

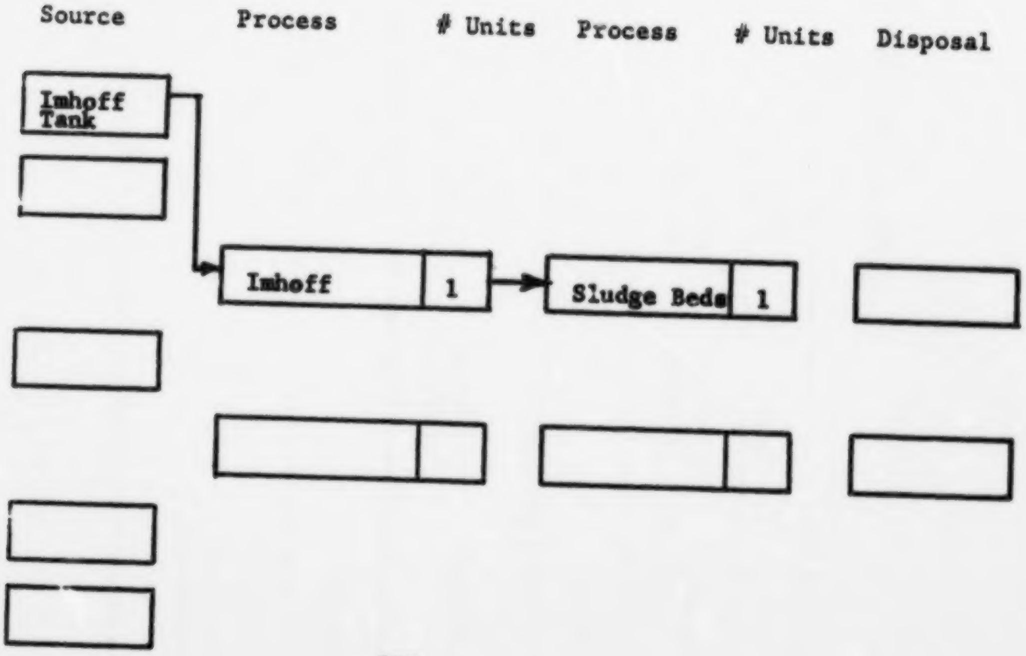
Virtually no operational control is exercised in the supervision of this plant operation. Should the facilities be expanded, it will be necessary to provide a trained operator with sufficient skill to insure that the plant is operated properly. This supervision must necessarily include laboratory analysis and the keeping of records to reflect plant performance. Prison labor may be used to carry out the directives of a competent operator.

FEDERAL CORRECTIONAL INSTITUTION
FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	Screen	Bar Screen - Manually Cleaned
1	Sedimentation	Imhoff Tank
1	Filtration	Trickling Filter
	Receiving Stream	Bear Creek

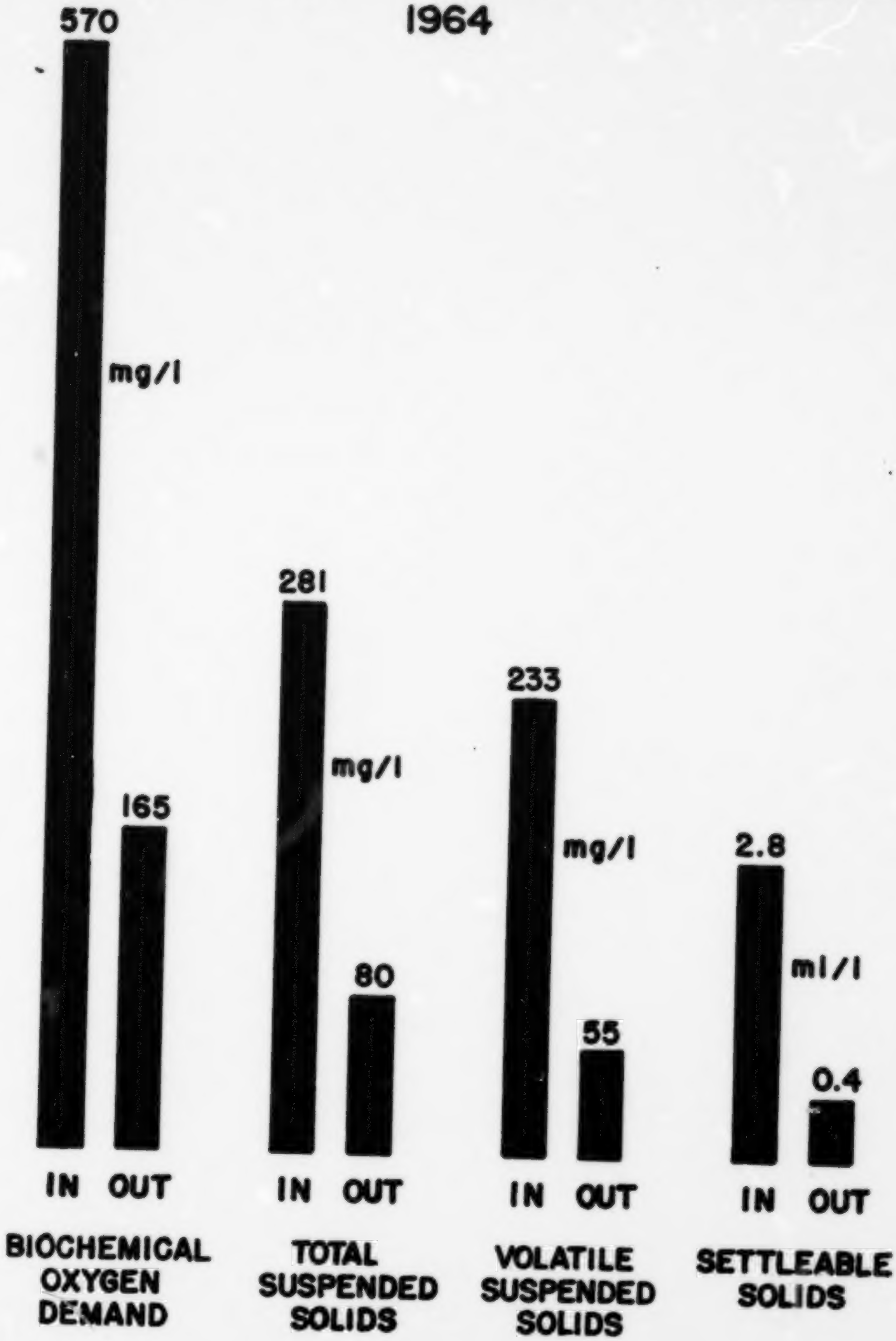
Solids Diagram


Source
Process
# Units
Process
# Units
Disposal
Imhoff Tank
Imhoff
1
Sludge Beds
1

FEDERAL CORRECTIONAL INSTITUTE SEWAGE TREATMENT PLANT

	Date	Time	Sample Type	BOD	TSS	VSS	Settleable Solids
Effluent	12/29/64	8AM-3PM	Comp	134	69	53	0.2
	12/30/64	8AM-3PM	Comp	200	91	58	0.5
Average				165	80	55	0.35
Influent	12/29/64	8AM-3PM	Comp	545	278	234	3.0
	12/30/64	8AM-3PM	Comp	595	284	232	2.5
Average				570	281	233	2.75
Percent Removals				71	72	76	87

FEDERAL CORRECTIONAL INSTITUTION S.T.P.
PROJECT RECORD OF PLANT PERFORMANCE
1964



TOWN OF EVERGREEN

Type Treatment:	Intermediate
Population Served:	700 persons
Average Flow:	0.065 million gallons daily
Plant Capacity:	0.2 million gallons daily

Discussion:

The Town of Evergreen operates a secondary treatment facility adjacent to Bear Creek at the eastern edge of the Town of Evergreen (River mile 320.9/19.3). Facilities at this plant include a grit removal chamber, primary clarifier, trickling filter, and chlorination detention basin. The Town of Evergreen, considered a resort area, experiences a substantial increase in population during the summer months. As a result, flows are much higher at this time than during the winter.

Colorado State Department of Public Health sampling data indicates effluent BOD strength to be 67 mg/l. Samples collected and analyzed by Project personnel during the period June 10 through June 12, 1964 assigned a BOD of 80 mg/l to the effluent from this plant. During the same sampling period, an influent strength of 260 mg/l was recorded. An average plant reduction of 69 percent was reflected by Project sampling. The effluent quality expressed in terms of an equivalent population was 220 persons.

Chlorination facilities have been provided at this plant but are not presently in use. The plant operator informed Project personnel that these facilities have never been used.

A limited laboratory has been provided at the plant, but is not presently used by the operator.

Evaluation:

Effluent discharged from this plant is not currently in conformity with State standards for domestic waste discharges. Compared to the plant design capacity, present efficiency is far below the degree of treatment which should have been provided by this facility. Increased emphasis on the operation of the plant should result in greater efficiency. However, should this not be the case, it is likely that a secondary clarifier should be provided.

Other than routine plant maintenance procedures, there is virtually no operational control undertaken by the plant operator. A satisfactory plan of operation should be prepared and followed by the plant operator in order that this plant reduce effluent discharge in terms of pollution loads to Bear Creek.

TOWN OF EVERGREEN
FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	Screening	Bar Rack
1	Flow Metering	
1	Shredding	Comminutor
1	Sedimentation	Circular
1	Filtration	High-rate trickling filter
1	Chlorine addition	Equipment not used
	Receiving Stream	Bear Creek

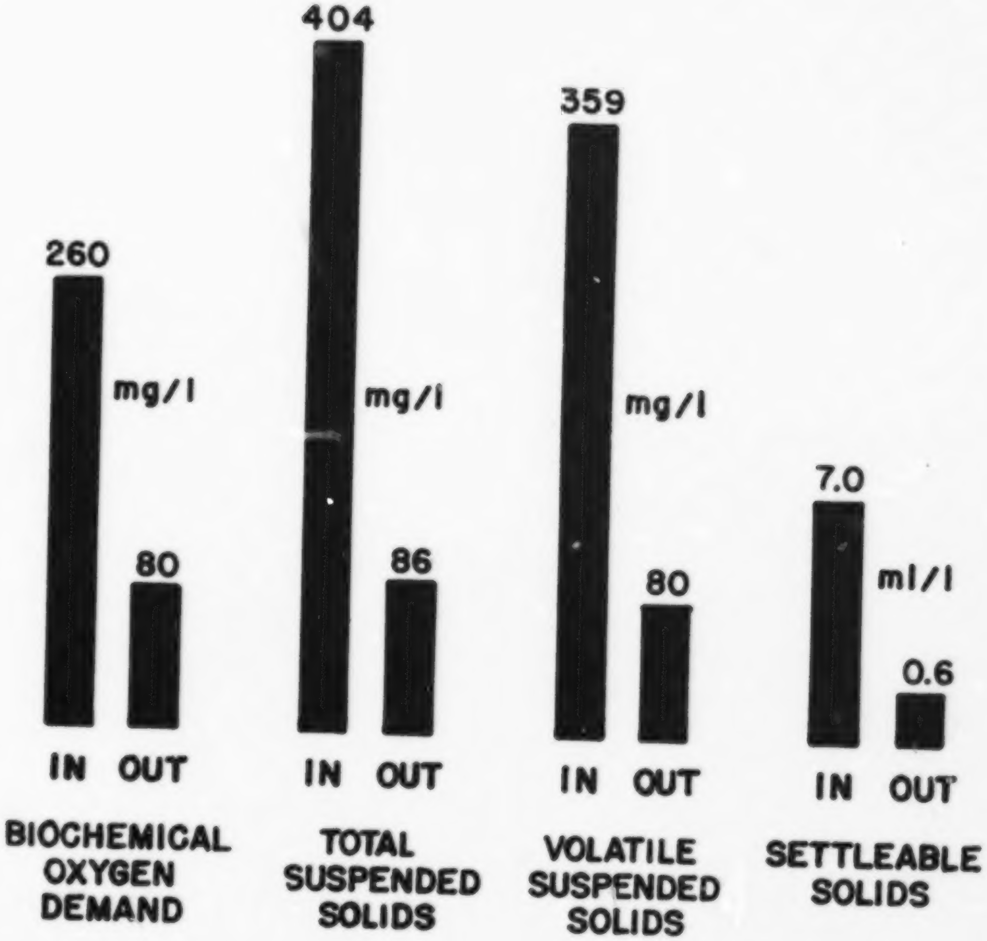
Solids Diagram

Source	Process	# Units	Process	# Units	Disposal
Primary Clarifier	Primary Anaerobic (Heated)	1	Field		

EVERGREEN SEWAGE TREATMENT PLANT

	Date	Time	Sample Type	Temp	pH	BOD	TSS	VSS	Sett Solids	Cl_2Res	Total Coli	Fecal Coli
Effluent	6/ 2/64	1500	Grab	--	--	--	--	--	--	--	$3.3x10^6$	$4.6x10^5$
	6/10/64	8AM-3PM	C-8	--	--	88	98	96	0.5	--	--	--
	6/11/64	8AM-3PM	C-8	--	--	75	78	73	0.4	--	--	--
	6/12/64	8AM-3PM	C-8	--	--	77	82	70	1.0	--	--	--
Average						80	86	80	0.6		$3.3x10^6$	$4.6x10^5$
Influent	6/10/64	8AM-3PM	C-8	--	--	250	600	533	10.0	--	--	--
	6/11/64	8AM-3PM	C-8	--	--	245	188	172	4.0	--	--	--
	6/12/64	8AM-3PM	C-8	--	--	280	425	373	7.0	--	--	--
Average						260	404	359	7.0			
Percent Removals						69	79	78	91			

TOWN OF EVERGREEN S.T.P.
PROJECT RECORD OF PLANT PERFORMANCE
1964



ROCKY MOUNTAIN ARSENAL

Type Treatment:	Intermediate
Population Served:	231 persons
Average Flow:	0.2 million gallons daily
Plant Capacity:	0.6 million gallons daily

Discussion:

The Rocky Mountain Arsenal, located northeast of the City of Denver, discharges effluent from its sewage treatment plant into First Creek, an intermittent stream which intercepts the Burlington Canal. The Burlington Canal is an irrigation ditch used to divert South Platte River water to Barr Lake. It is unlikely that effluent from the Arsenal sewage treatment plant actually reaches Barr Lake. Infrequent supervision of this facility is provided by Rocky Mountain Arsenal personnel. Two operators have the responsibility to provide routine maintenance for a total of 21 hours per week.

A chlorinator which was provided in the plant design was discarded in 1945. No effort has been made to replace the equipment and chlorinate the effluent.

Laboratory tests which are performed by plant personnel include pH, settleable solids, and relative stability of the final effluent daily. Records include flow, rainfall, air temperature, wind direction, and effluent temperature.

Evaluation:

Present plant performance appears to be satisfactory in terms of both effluent quality and plant capacity.

More attention should be given to the operation of this plant through increased supervision of the plant operation. More attention should also be given to maintenance of the Imhoff tanks and an increased surveillance of the sludge production. Plant records indicate that sludge was last removed from the Imhoff tanks two years ago.

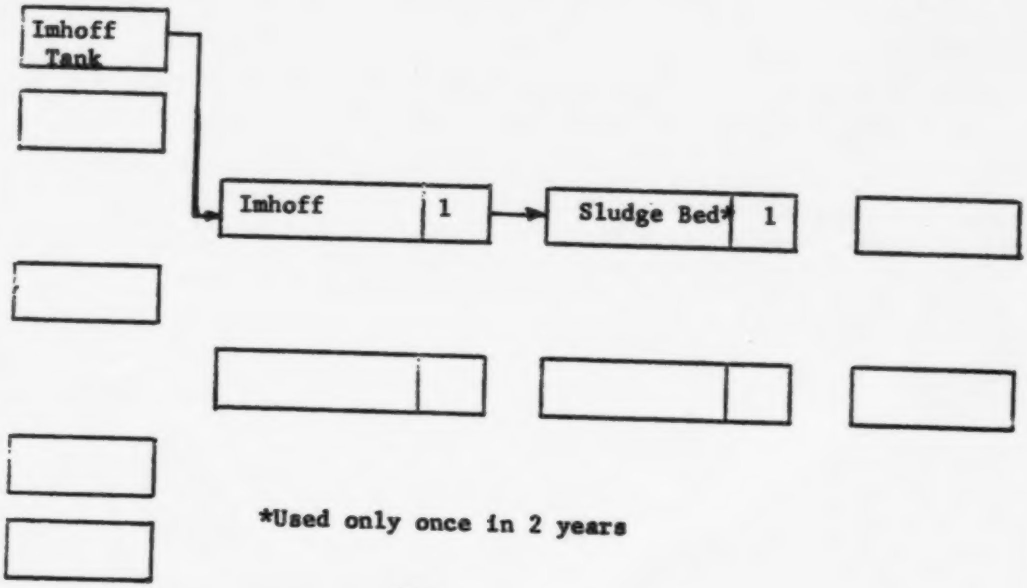
ROCKY MOUNTAIN ARSENAL
FLOW DIAGRAM

Liquid Diagram

# Units	Process	Operation Description
1	Screening	
1	Sedimentation	Imhoff tank
2	Filtration	Rotary Distributed - used alternately
1	Chlorine Addition	Abandoned in 1945
	Receiving stream	Ditch to First Creek

Solids Diagram

Source	Process	# Units	Process	# Units	Disposal



*Used only once in 2 years